CONTROL DATA

60000123

Central Processing Unit (CPU) Hardware Maintenance

MAINTENANCE Guide

/ CYBER 960/962
Computer System

CYBER 960/962 Computer System
Central Processing Unit (CPU)

Maintenance Guide

This product is intended for use only as described in this document. Control Data cannot be responsible for the proper functioning of undescribed features and parameters.

Publication Number 60000123

Manual History

This manual is revision A, printed October 1988.

Revision	Change Order	Date	Reason for Change
A		10-04-88	Manual released.

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Equipment Supported in This Manual

This manual supports the following equipment at the series levels listed, assuming all field change orders (FCOs) against the equipment have been installed. Compare the list of FCOs in this table with the list in your equipment FCO log. If the two lists match, this manual accurately reflects your equipment.

Equipment	Series	FCOs	Comments
AD121-A	01		Released.
AD122-A	01		Released.
AU133-A	01		Released.
AU134-A	01		Released.
BS226-A	01		Released.
BS227-A	01		Released.

About This Manual

The manual provides detailed maintenance information for the CONTROL DATA® CYBER® 960/962 CPU which includes the central processor (CP), central memory (CM), and central memory control (CMC).

Audience

This manual is for use by experienced field personnel who are familiar with Control Data computing systems and Control Data maintenance practices.

Organization

The information in this manual supplements the maintenance software manuals and the theory and diagrams manuals. It contains the following chapters:

- Introduction – describes the types of procedures in this manual, as well as the maintenance strategy for the CYBER 960/962 CPU.
- Parts/Tools – identifies the field-replaceable units (FRUs) by part number and description and shows their location on the CPU. It also contains the contents of the spares kit as well as all special tools.
- Preventive Maintenance – contains the procedures required to perform preventive maintenance on the CYBER 960/962 CPU.
- Removal/Replacement Procedures – contains the procedures used to remove and replace any field-replaceable unit.
- Appendix A – contains a glossary.

Conventions

New features, as well as changes, deletions, and additions to this manual, are indicated by vertical bars in the margins.

Radio Frequency Warning

⚠WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a class A computing device and peripheral computing devices pursuant to Subpart J of part 15 of the FCC Rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Related Manuals

This manual and other related manuals are listed in the CYBER 960/962 Hardware Manuals set figure on the following page.

Submitting Comments

Control Data welcomes your comments about this manual. Your comments may include your opinion of the usefulness of this manual, your suggestions for specific improvements, and the reporting of any errors you have found.

You can submit your comments on the comment sheet on the last page of this manual. If the manual has no comment sheet, mail your comments to:

CONTROL DATA
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CYBER 960/962 HARDWARE MANUALS

SYSTEM MANUALS

Site Preparation

- General Information Site Preparation — 60275100
- Mainframe Complex Data Site Preparation — 60000119
- Peripheral Equipment Data Site Preparation — 60275300

Installation

- Mainframe Installation and Checkout — 60000120

Operation

- Virtual State Reference, Volume 1 — 60000132
- Virtual State Reference, Volume 2 — 60000133
- CYBER 170 State Reference — 60000127
- 19003 System Console Operations/ Maintenance — 60463610

Troubleshooting

- System Troubleshooting — 60000122

Codes

- System Codes Booklet — 60458100

EQUIPMENT MANUALS

Central Processing Unit (CPU)

- CPU Maintenance — 60000123
- CPU Theory and Diagrams — 60000118

Mainframe Power and Environmental

- Mainframe Power and Environmental Subsystem Maintenance — 60000125
- Mainframe Power and Environmental Subsystem Theory and Diagrams — 60000121

Input/Output Unit (IOU)

- IOU Maintenance — 60000130

CYBER 960 IOU Manuals

- IOU Theory and Diagrams, Levels 0-3 — 60463540
- IOU Diagrams, Level 4 — 60462210
- Wire Lists Microfiche — 60000134

CYBER 962 IOU Manuals

- IOU Theory and Diagrams, Levels 0-3 — 60000235
- IOU Diagrams, Level 4 — 60000236
- Wire Lists Microfiche — 60000135

Motor Generator (MG) Equipment

- 25-kVA Frequency Converter Hardware Maintenance — 60456520
- 40-kVA Control Cabinet and Motor Generator Hardware Maintenance — 60454720
- MG Interface Unit Installation and Maintenance — 60000124

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Introduction 1

CYBER 960/962 Hardware Overview 1-1

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Introduction 1

This chapter provides an overview of the CYBER 960/962 system hardware, the preventive maintenance approach and the removal/replacement approach used on the CYBER 960/962 mainframe. This chapter also includes information for the customer engineer (CE) concerning maintenance-related issues.

CYBER 960/962 Hardware Overview

The CYBER 960 and 962 are Control Data's 180-architecture computer systems to support the mid-range of the computer market's mainframe needs through the early 1990's. CYBER 960/962 mainframes are an effective replacement for the CYBER 860 line, with a performance improvement of more than 50 percent.

CYBER 960 is dual-state (NOS and NOS/VE) while the CYBER 962 is strictly a single-state (NOS/VE) mainframe. Both systems are air-cooled and use large-scale integrated (LSI) emitter-coupled logic (ECL) arrays. The increased logic density translates into a significant reduction in the number of logic assemblies and the amount of space required to house the assemblies compared to previous systems.

The CYBER 960/962 is the first large-scale Control Data mainframe with its central processor(s), central memory, and central memory control packaged in one cabinet, which is referred to as the central processing unit (CPU).

A fully-configured CYBER 960/962 system is shown in figure 1-1 and includes, but is not limited to, the following elements.

Central Processing Unit (CPU)

A single cabinet housing the central processor (CP), basic central memory (CM) of 64 megabytes, and central memory control (CMC).

Power Unit

A single cabinet attached to the CPU, which supplies power to the CPU and monitors power and environmental factors for both the CPU and input/output unit(s).

Input/Output Unit (IOU)

A single cabinet attached to the CPU; this primary IOU is of a nonconcurrent input/output (NIO) architecture on the CYBER 960, and concurrent input/output (CIO) architecture on the CYBER 962.

System Console

Tabletop unit that includes a monitor, keyboard, and microprocessor.

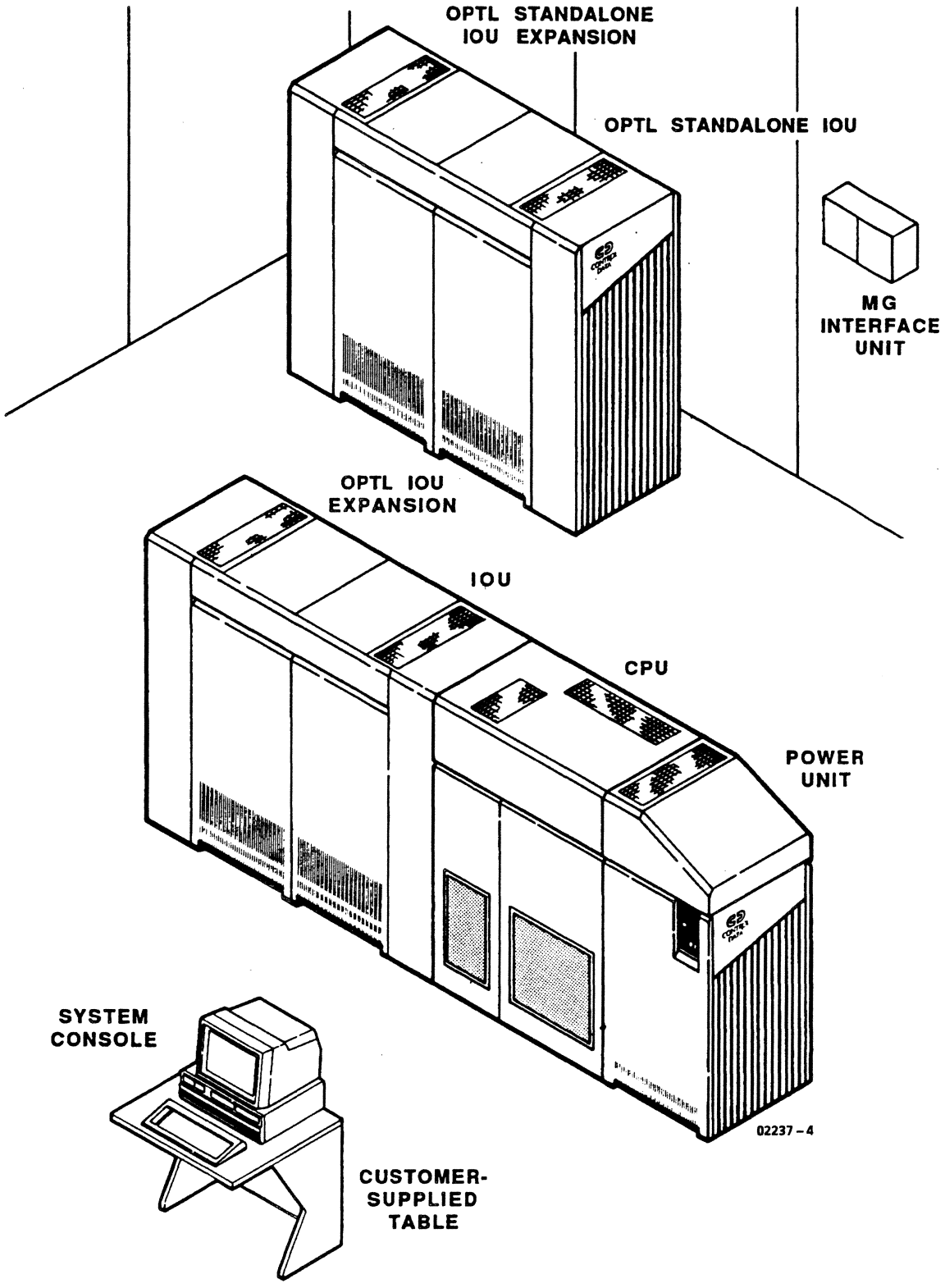
MG Interface Unit

Wall-mounted interface box that links the mainframe power unit to the MG or frequency converter.

Motor Generator (MG) Set (or Frequency Converter)

Converts 50- or 60-Hz power to 400-Hz power suitable for mainframe power distribution.

A variety of options are available to enable mainframe performance or input/output capacity to be upgraded. These options include processor performance upgrades, additional memory, and IOU expansion products.



NOTE:

1. Motor Generator is located in a separate room.

Figure 1-1. CYBER 960/962 Maximum System Configuration

Preventive Maintenance Overview

Preventive maintenance is periodically checking or reconditioning the equipment while it is in service. Preventive maintenance for the CYBER 960/962 differs considerably from previous CDC computer systems in several respects.

First, there is no on-site maintenance on the CYBER 960/962 system unless a site contracts for it. Maintenance is performed on an on-call basis only.

Second, although preventive maintenance tasks are grouped according to frequency of occurrence, the grouping is approximate. If possible, perform preventive maintenance procedures when in the general area of the site. Do not schedule special visits to a site just to perform preventive maintenance procedures.

Third, the simplicity of the CPU design is such that there are only a two preventive maintenance tasks.

Detailed procedures for performing the preventive maintenance tasks are covered in chapter 3.

Removal/Replacement Overview

Removal/replacement is the systematic elimination of a hardware fault after the fault has been isolated to a failing field-replaceable unit (FRU). Isolating the fault to the failing FRU is accomplished through the use of the System Troubleshooting Guide or through the guidance of CYBER Hardware Support, and correcting the fault is accomplished by replacing the failing FRU.

Detailed procedures for removal and replacement of FRUs are covered in chapter 4.

After locating and correcting the fault, verify the repair using the same diagnostics that detected the fault. Unless directed otherwise, dispose of non-repairable FRUs locally, and return repairable FRUs within 48 hours to:

FRU
4201 North Lexington Avenue
M/S ARH 227
Arden Hills, MN 55126-6198

Be sure to include the Fault Symptom Code (FSC), if any, with the completed Maintenance Action Form (MAF) and any special reporting forms. The FSCs as well as solutions to corrected problems are input to the fault symptom data base established to help others in troubleshooting and repair.

If the customer maintains a site log, be sure to make the appropriate entries in the log.

Customer Engineer Information

When working on a system, the customer engineer (CE) must be aware of electostatic discharge requirements and the procedure for field change orders (FCOs) in addition to preventive maintenance and removal/replacement procedures.

Electrostatic Discharge Requirements

To avoid damage to static-sensitive parts, follow these electrostatic discharge (ESD) requirements:

1. Use an antistatic wrist strap, grounded to the chassis, when handling modules in the equipment.
2. Place modules in antistatic bags when carrying them.
3. Work only on a grounded workstation when installing field change orders (FCOs) or when handling modules away from the equipment.

For more information, refer to ES Procedure 4.500, How Electrostatic Parts are Handled.

Field Change Orders (FCOs)

If the FCO consists of a simple module replacement, or a microcode change, it will be installed by the maintenance CEs. Soldering on logic modules, however, will not be performed by maintenance CEs. Because a high level of soldering expertise is required to modify modules, field change orders (FCOs) to these modules are installed by replacing the module, sending out FCO teams, or implementing a round-robin FCO.

Parts/Tools 2

CPU Field-Replaceable Units (FRUs) 2-1

CPU Spares Kit 2-7

Special Tools 2-8

Parts/Tools 2

This chapter contains parts information for the CYBER 960/962 CPU field replaceable units (FRUs). It also contains the spares kit listing, as well as a listing of special tools required for the preventive maintenance and removal/replacement procedures covered in this manual.

CPU Field-Replaceable Units (FRUs)

Table 2-1 describes the FRUs, gives their part number, and references figures 2-1 through 2-3 to show their location on the CPU.

Table 2-1. Field Replaceable Units (FRUs)

FRU Description	Part Number	Figure Number	Find Number
Air Filters			
CM Front	15481565	2-2	12
CP Front	15481566	2-1	10
CM Rear	00815451	2-3	18
CM Backpanel	22110380	2-3	17
Blower Assembly			
CM Blower Assembly 1/3 HP	15481554	2-2	11
CP Blower Assembly 1.5 HP	15481556	2-1	2
CP Cage			
CP-0 Cage	22111871	2-1	1
CP-1 Cage	22177455	2-1	4
CM Control Module	22110374	2-3	15
CM Memory/Regulator Module			
Terminated Memory Module	22110376	2-2	13
Unterminated Memory Module	22110378	2-2	13
Voltage Regulator Module	10282373	2-2	14
CP Module[1]		2-1	3
AC	10298896		
ALN	22110346		
BDP	22110348		
CSTMAC	22110354		
IFIC	22110356		
LMA	22110358		
LMB	22110360		
MD	22110362		
OPIA	22110364		
OPIB	22110366		
OPISM	22110368		
CMCA	22110350		
CMCB	22110352		

(Continued)

Table 2-1. Field Replaceable Units (FRUs) *(Continued)*

FRU Description	Part Number	Figure Number	Find Number
CP Regulator Pak	22127618	2-1	6
SIB Cables			
SIB to CM	22137205	2-3	16
SIB to IOU		2-1	5
- CYBER 960	22137204 10269102 10269103 10269104		
- CYBER 962	22137204		
SIB to SIB	22137206	2-1	7
SIB to Power Unit	10283756	2-1	9
Shorting Plug	15480343	2-1	8
Temperature Sensor[2]	22133906	-	-

1. Slot locations for individual modules are shown in figure 4-25.

2. Temperature sensor locations are shown in figures 4-49 and 4-50.

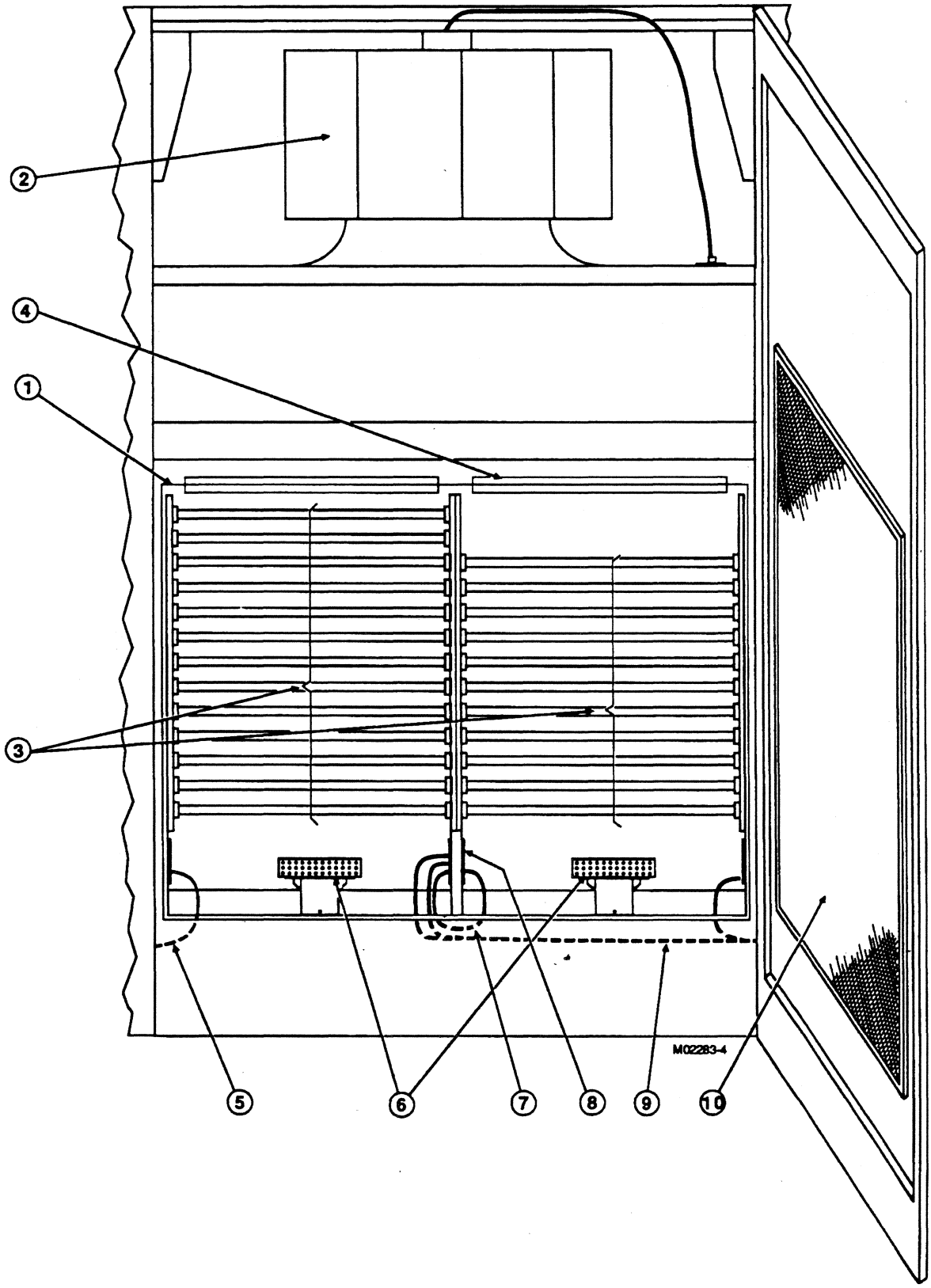


Figure 2-1. Central Processor, Front View

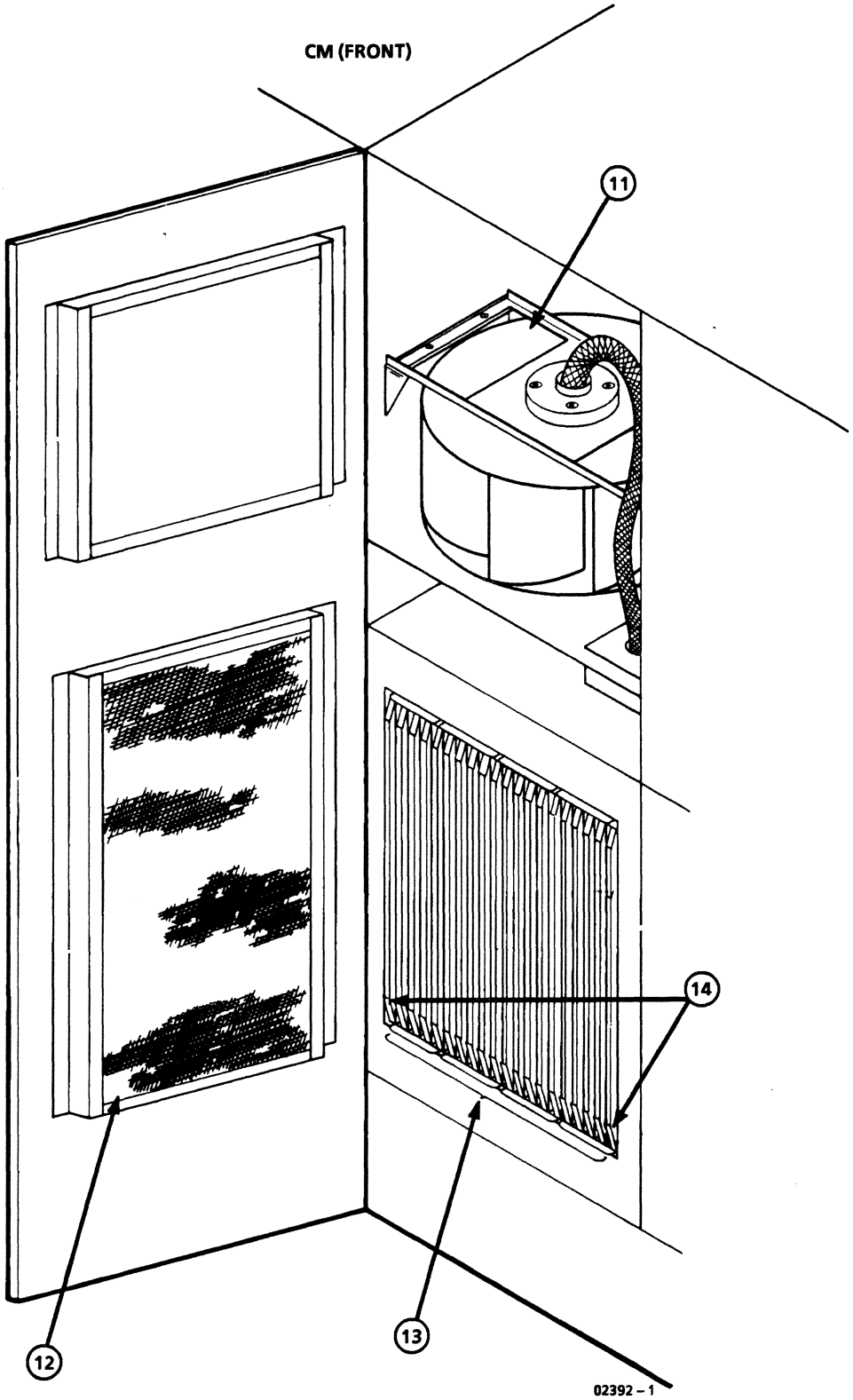


Figure 2-2. Central Memory, Front View

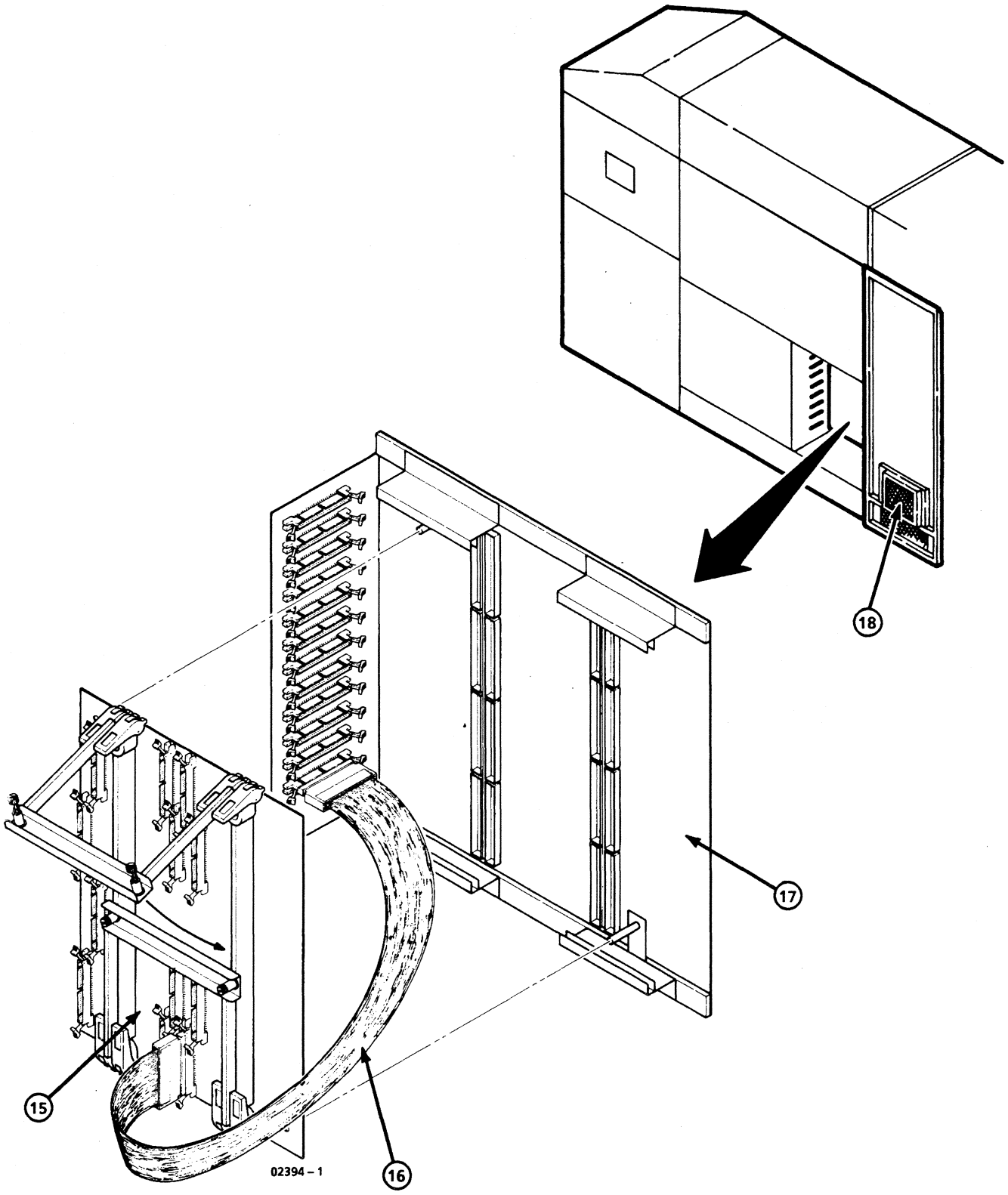


Figure 2-3. Central Memory, Rear View

CPU Spares Kit

Engineering Services recommends that the parts listed in the CPU Spares Kit in table 2-2 be kept in a spares depot and made available to each site in case of failure.

Table 2-2. CPU Spares Kit

Part Description	Part Number
CP Spares Case	**75448206**
AC	10298896
ALN	22110346
BDP	22110348
CMCA	22110350
CMCB	22110352
CSTMAC	22110354
IFIC	22110356
LMA	22110358
LMB	22110360
MD	22110362
OPIA	22110364
OPIB	22110366
OPISM	22110368
CM Spares Case	**75447681**
CM Control Module	22110374
Terminated Memory Module	22110376
Unterminated Memory Module	22110378
Power Spares Case	**75447674**
+5/-2 V Memory Regulator Module	10282373
-2.0 V CP Regulator Pak	22127618
Power Control Display	22127624
Power Control Protect	22127626
Temperature Sensor	22133906

Special Tools

Table 2-3 gives the special tools required for the preventive maintenance and removal/replacement procedures covered in this manual.

Table 2-3. Special Tools

Tool Description	Part Number
Bags, antistatic	12263627
Connector cover	00182756
Filter coating	15447960
Gauge, connector alignment	00182708
Grease, electrical conductive	95353800
Insertion/extraction tool	12215151
Pin straightener, connector	00182709
Quick Release	22114090
Wrench, torque, 1000 lbf•in	12205640

Preventive Maintenance 3

Check Chassis Temperatures 3-2
Replace and Clean CPU Air Filters 3-4

Preventive Maintenance 3

There is no regular scheduled maintenance on a CYBER 960/962 mainframe. Perform the procedures in this chapter as closely to the following prescribed intervals as possible without necessitating a special trip to the site.

Quarterly Task:

- Replace and clean air filters

Semiannual Task:

- Check chassis temperatures

Check Chassis Temperatures

Use this procedure to check CPU chassis temperatures semiannually. The temperatures are checked on the alphanumeric display of the system status panel on the power unit.

___ 1. Set Selector (left rotary switch) of system status panel to SCAN (figure 3-1).

___ 2. Use either FAST or SLOW scan setting on Function (right rotary switch) to display codes in MESSAGE in a continuous loop.

___ 3. When code designated for desired temperature check (table 3-1) appears on the MESSAGE display, turn Function switch to HOLD. This stops display with temperature displayed in DATA.

___ 4. Compare displayed value with nominal value listed in table 3-1.

___ 5. If temperature is at warning value or above, contact CYBER Hardware Support for technical assistance.

___ 6. Repeat steps 2 through 5 for remaining temperature checks.

Table 3-1. Temperature Sensing Codes

Code Displayed in MESSAGE	Temperature Displayed in DATA	Nominal Value[1]	Warning Value[1]
F0	Temperature of room ambient air[2]	N/A	89
	_____ *Write value here for comparison with temperatures that follow*		
CF1	Temperature from CP-0 outlet sensor	18 or less above value for F0	32 above value for F0
CF2	Temperature from CP-1 outlet sensor	18 or less above value for F0	32 above value for F0
CF3	Temperature from memory 1 outlet sensor	10 or less above value for F0	32 above value for F0
CF4	Temperature from memory 2 outlet sensor	10 or less above value for F0	32 above value for F0

Notes:

1. Voltage values are listed with their tolerances. All temperatures listed are in Fahrenheit and all temperature values displayed are in Fahrenheit [(°F - 32) x 0.56 = °C].

2. Temperature of room ambient air is an average between temperatures from CP and CM ambient sensors.

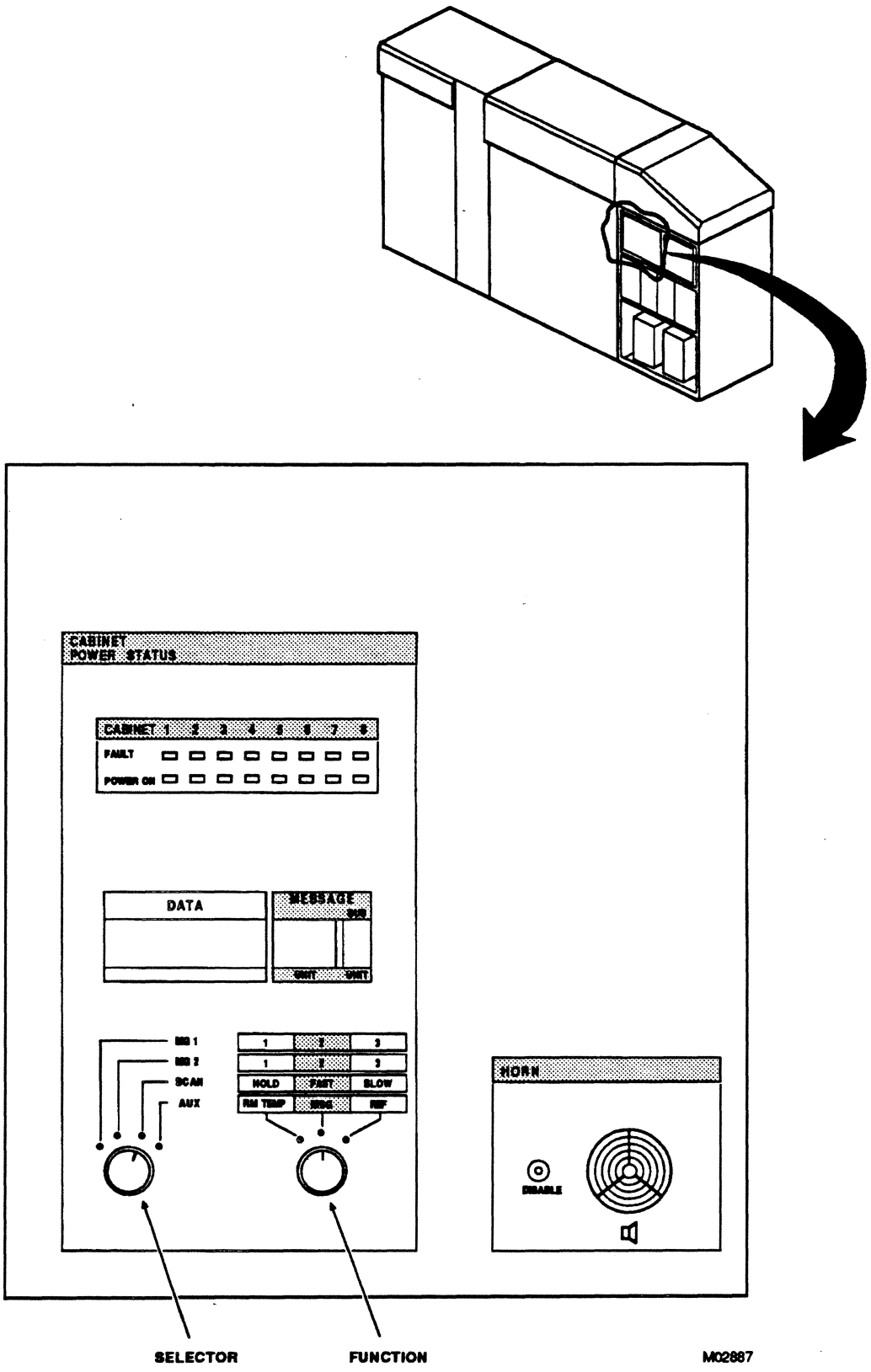


Figure 3-1. System Status Panel

Replace and Clean CPU Air Filters

Use this procedure to replace and clean CPU air filters. Although filters may be changed while the system is powered up, do not run the system for an extended period of time without filters.

NOTE

Engineering Services recommends keeping a cleaned set of air filters on the site, and rotating spare filters with filters in the system.

Clean and replace the filters quarterly. When replacing filters, also inspect the cabinets for unusual accumulations of fine dust. Rotate the filters more frequently if the site is dusty.

⚠CAUTION

Do not install wet or damp filters. The high volume of air circulated through the filters pull the moisture into the cabinet.

Tools/parts required

- Wrench, 5/16-in Allen
- Spare set of filters (recommended)
- Filter Coating
- Detergent, mild dishwashing
- Brush, soft with long bristles

Removal

___ 1. Open CP and CM front doors and CM rear door.

___ 2. Remove the three filters according to applicable substep.

___ a. Lift CM rear door filter out of door bracket.

___ b. Push up against CM or CP front filter through cutouts in filter bracket (figure 3-2) until bottom of filter clears bracket. Swing bottom of filter out and pull down to remove filter.

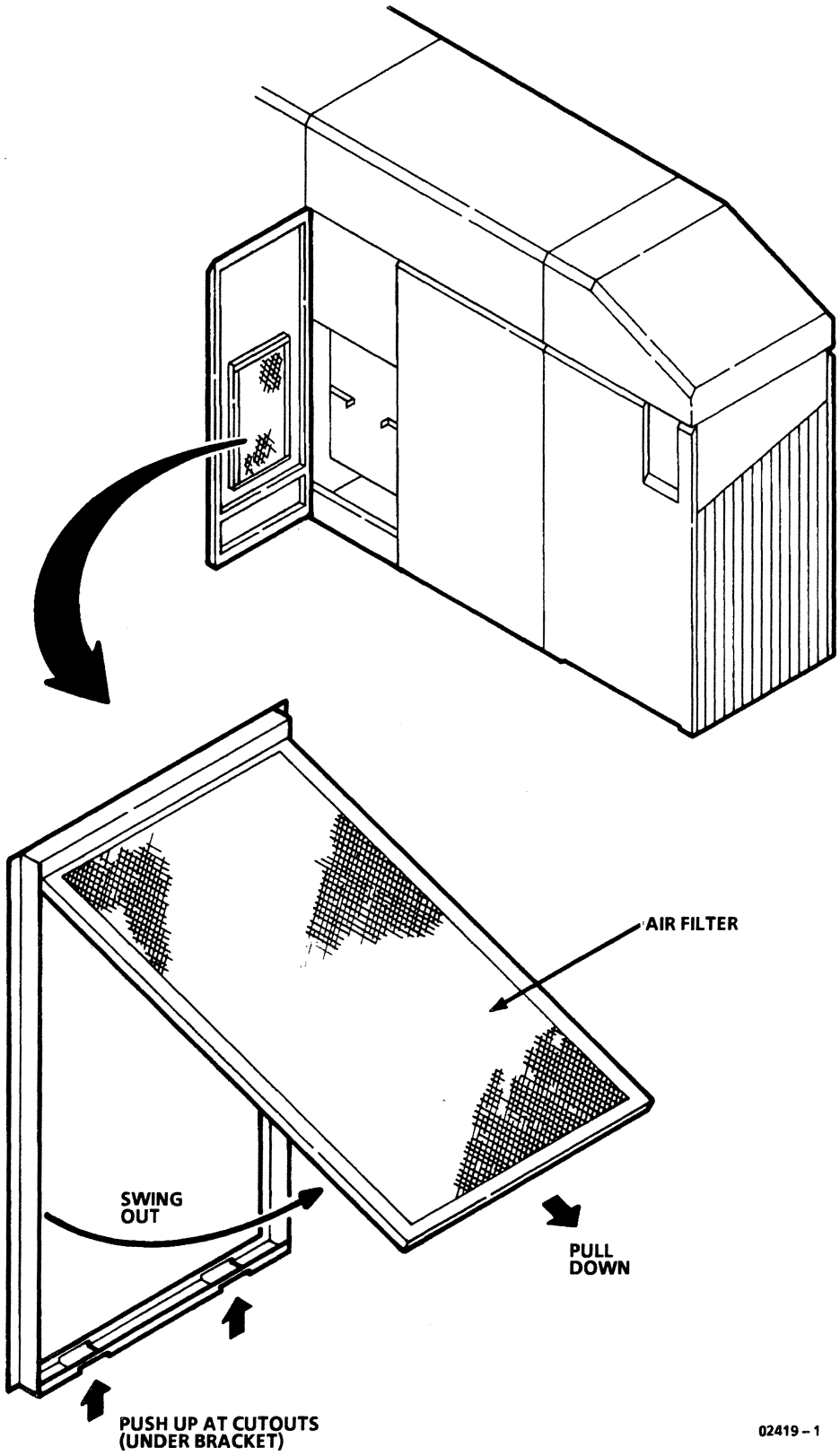


Figure 3-2. CP and CM Front Filter Removal

Replacement

___ 1. Observe airflow indicator on edge of front filters and spray filter coating evenly on inside of all three filters according to directions printed on filter coating container.

___ 2. Install replacement filters according to applicable substep.

___ a. Place CM rear filter into door bracket.

___ b. Insert top of CM or CP front filter into filter bracket, then swing bottom of filter into bracket. Slide entire filter down until bottom of filter is flush in bracket.

Cleaning

___ 1. Prepare a solution of mild dishwashing detergent and warm water.

___ 2. Soak filters until dirt can be easily removed with a soft-bristled brush.

___ 3. Rinse filters thoroughly and set aside to dry.

___ 4. Store filters in clean, dry location for use in next filter replacement.

NOTE

Do not spray filter coating on the filters until just before they are installed.

Removal and Replacement 4

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Removal and Replacement 4

This chapter provides procedures to remove and replace field-replaceable units (FRUs) in the CPU. Instructions for removing power from the CPU as well as a list of special tools and parts used in this chapter are found on the following pages. Tools and parts required for each procedure are listed at the beginning of the procedure. A list of the procedures in this chapter is given on the preceding page.

Refer to the Replace and Clean CPU Air Filters procedure in chapter 3 to remove and replace CPU air filters.

Removing power from the CPU is the first step in each procedure and is illustrated here. Before beginning any procedure in this chapter, remove power from the CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE (figure 4-1). When instructed to do so, also remove 50/60- and 400-Hz power at the site source.

Provide access to the CPU by removing doors and end panels as required. Door removal steps are not included in the procedures.

⚠CAUTION

Most procedures require antistatic protection. Always wear an antistatic smock, and wear an antistatic wrist strap when instructed to do so.

Tools and parts used in this chapter include:

- Bags, antistatic
- Cover, connector
- Gauge, connector alignment
- Grease, electrical conductive (EJC No. 2)
- Insertion/extraction tool
- Nutdriver, 1/4 in
- Pin straightener, connector
- Quick Release
- Screwdriver set, Torx (with short handle)
- Screwdriver, Phillips
- Screwdriver, slotted
- Socket set, 3/8-in drive
- Socket set, metric
- Wrench, Allen, 5/16 in
- Wrench, torque, 1000 lbf·in
- Wrist strap, antistatic

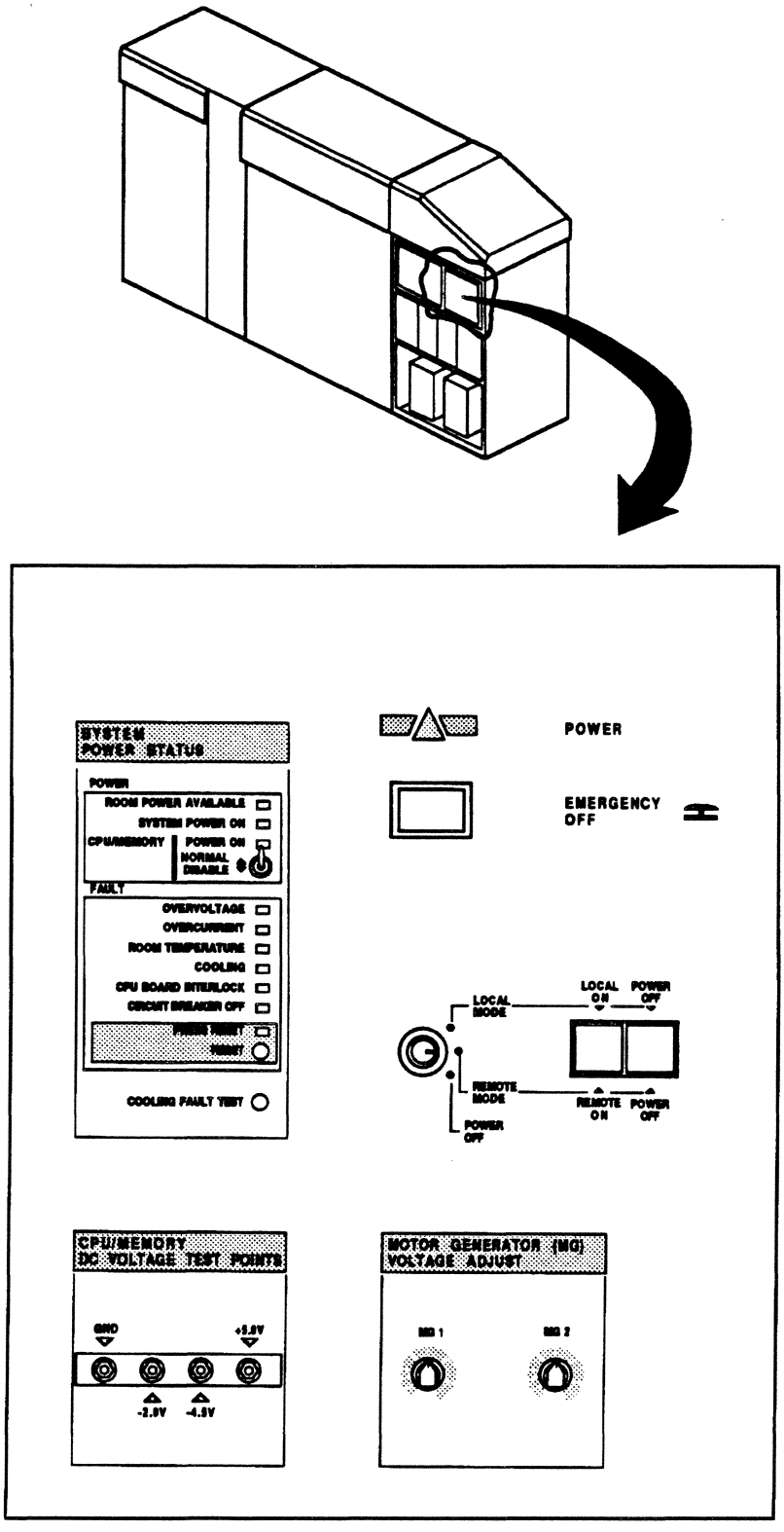


Figure 4-1. Main Control Panel

CM Backpanel Removal and Replacement

Use this procedure to remove and replace the CM backpanel.

Tools/parts required

- Wrist strap, antistatic
- Bags, antistatic
- Socket set, 3/8-in drive, or Torx screwdriver set
- Grease, electrical conductive (EJC No. 2)
- Wrench, torque, 1000 lbf·in

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE and switching off 50/60- and 400-Hz power at the site source.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Remove CM card cage cover plate (figure 4-2).

___ 4. Locate voltage regulator module in slot 2 and pull on upper and lower extractor levers at the same time to loosen module.

NOTE

Record slot locations before removing modules to ensure correct replacement.

___ 5. Remove voltage regulator module from CM card cage and place in antistatic bag.

___ 6. Repeat steps 4 and 5 with all memory and regulator modules in the CM card cage.

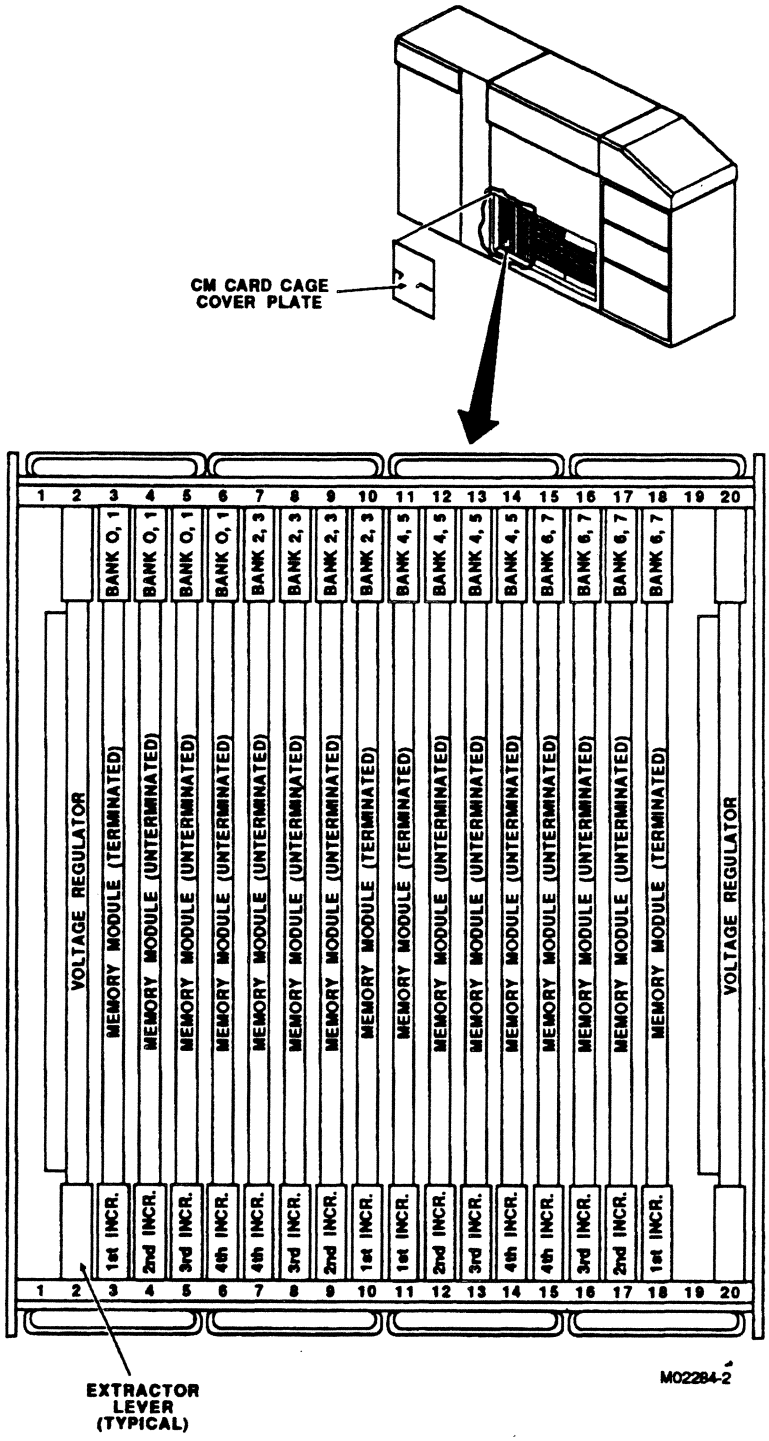


Figure 4-2. CM Module Location

___ 7. Open connector latches, and remove all SIB cables plugged into back of CM control module (figure 4-3).

___ 8. Loosen spring-loaded retaining screws on extractor levers.

⚠CAUTION

Use extractor levers to support module during removal and make sure module comes out as evenly as possible to prevent damage to pins.

___ 9. Pull both extractor levers back and out at the same time to release control module.

___ 10. Remove control module and place in antistatic bag.

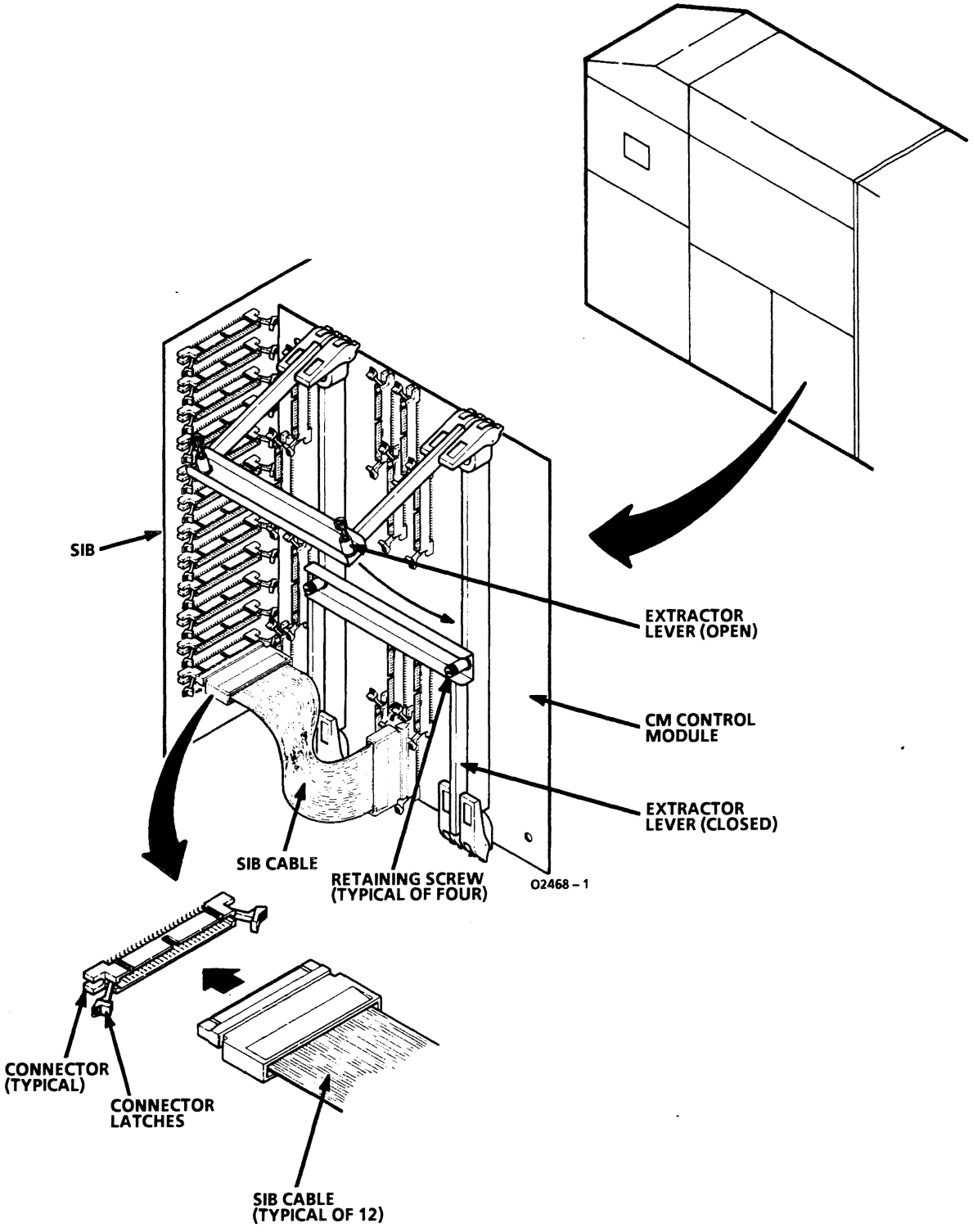


Figure 4-3. CM Control Module SIB Cable Locations

NOTE

Before unplugging J2 and J3, carefully record their orientations and position on the pins in order to replace them correctly.

___ 11. Label and unplug J2 and J3 (figure 4-4).

___ 12. Remove extractor bracket mounting bolts and remove brackets.

___ 13. Remove air duct.

___ 14. Label, if necessary, and remove capacitor leads from bus bars and current shunt.

⚠CAUTION

Take care not to bend backpanel pins when removing bus bars.

___ 15. Remove mounting bolts from −4.5-V bus bar and remove bus bar.

⚠CAUTION

Remove bolts from base of bus bars first so weight of bus bar does not rest on current shunt.

___ 16. Remove mounting bolts from +5.0-V bus bar and remove bus bar.

___ 17. Remove mounting bolts from current shunt and remove current shunt.

___ 18. Remove mounting bolts from −2.2-V bus bar and remove bus bar.

___ 19. Remove backpanel retaining bolts and remove backpanel.

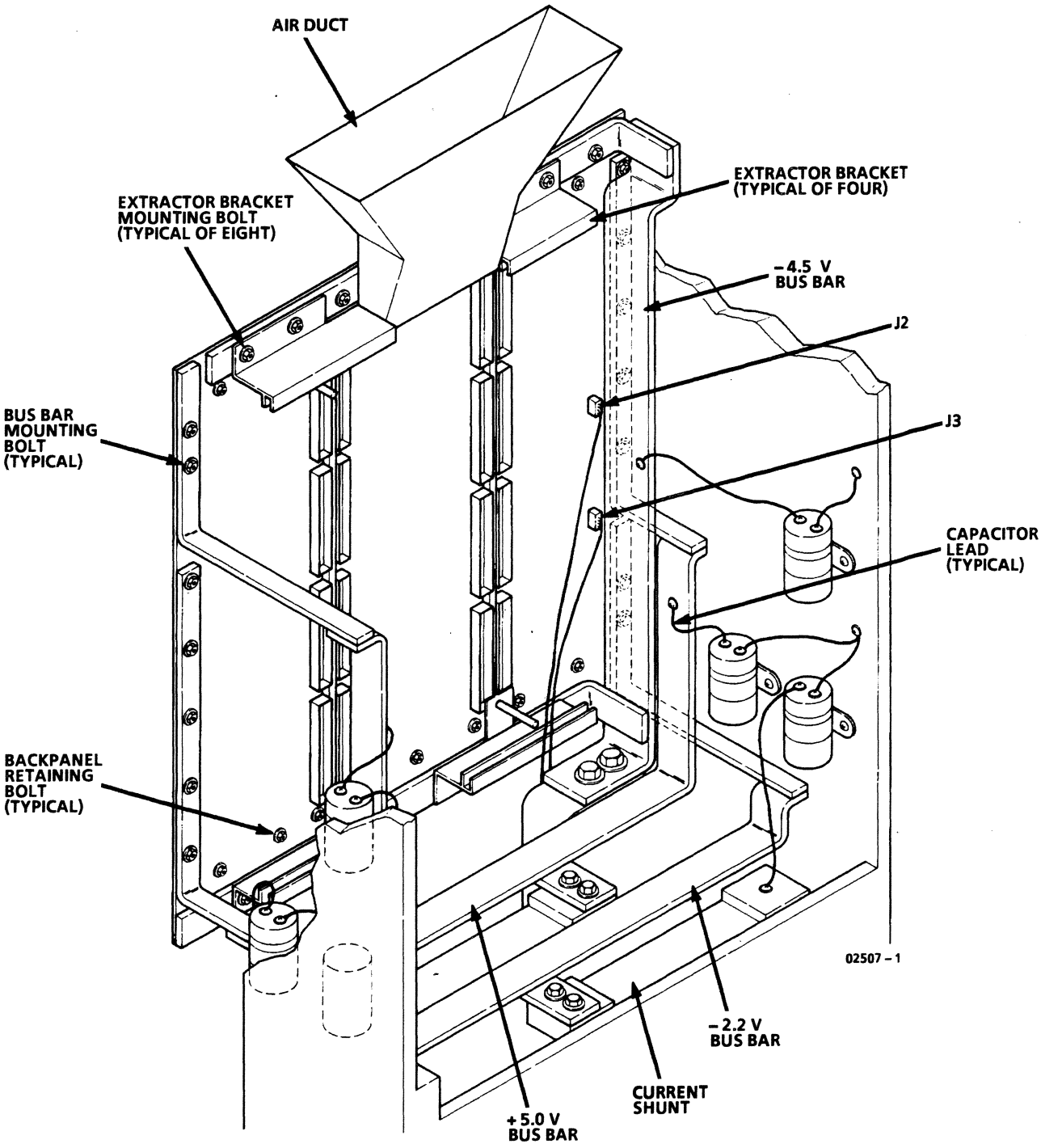


Figure 4-4. CM Backpanel

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

NOTE

Two CEs are required to replace backpanel. One must hold the backpanel in place while the other positions the CM guide rail knobs to fit into the backpanel notches.

___ 2. Hold backpanel in position while inserting one or two retaining bolts. Insert remaining retaining bolts and tighten.

⚠CAUTION

Before installing bus bars, wipe mating surfaces between bus bars with a clean, dry, soft cloth and lightly coat with electrical conductive grease (EJC No. 2). Do not put grease on mating surfaces between bus bars and backpanel.

___ 3. Replace −2.2-V bus bar (figure 4-5). Using a torque wrench, tighten bus bar to backpanel mounting bolts to 5.6 N•m (50 lbf•in), and tighten bus bar to current shunt bolts to 7.3 N•m (65 lbf•in).

___ 4. Replace current shunt and tighten mounting bolts.

___ 5. Replace +5.0-V bus bar. Torque bus bar to backpanel mounting bolts to 5.6 N•m (50 lbf•in), and torque bus bar to shunt bolts to 7.3 N•m (65 lbf•in).

___ 6. Replace −4.5-V bus bar. Torque bus bar to backpanel mounting bolts to 5.6 N•m (50 lbf•in) and bus bar to shunt bolts to 7.3 N•m (65 lbf•in).

___ 7. Replace capacitor leads.

___ 8. Replace air duct and tighten bolts.

___ 9. Replace extractor brackets and insulators and tighten mounting bolts.

___ 10. Connect J2 and J3 making sure that orientation and position on pins are exactly as recorded upon removal.

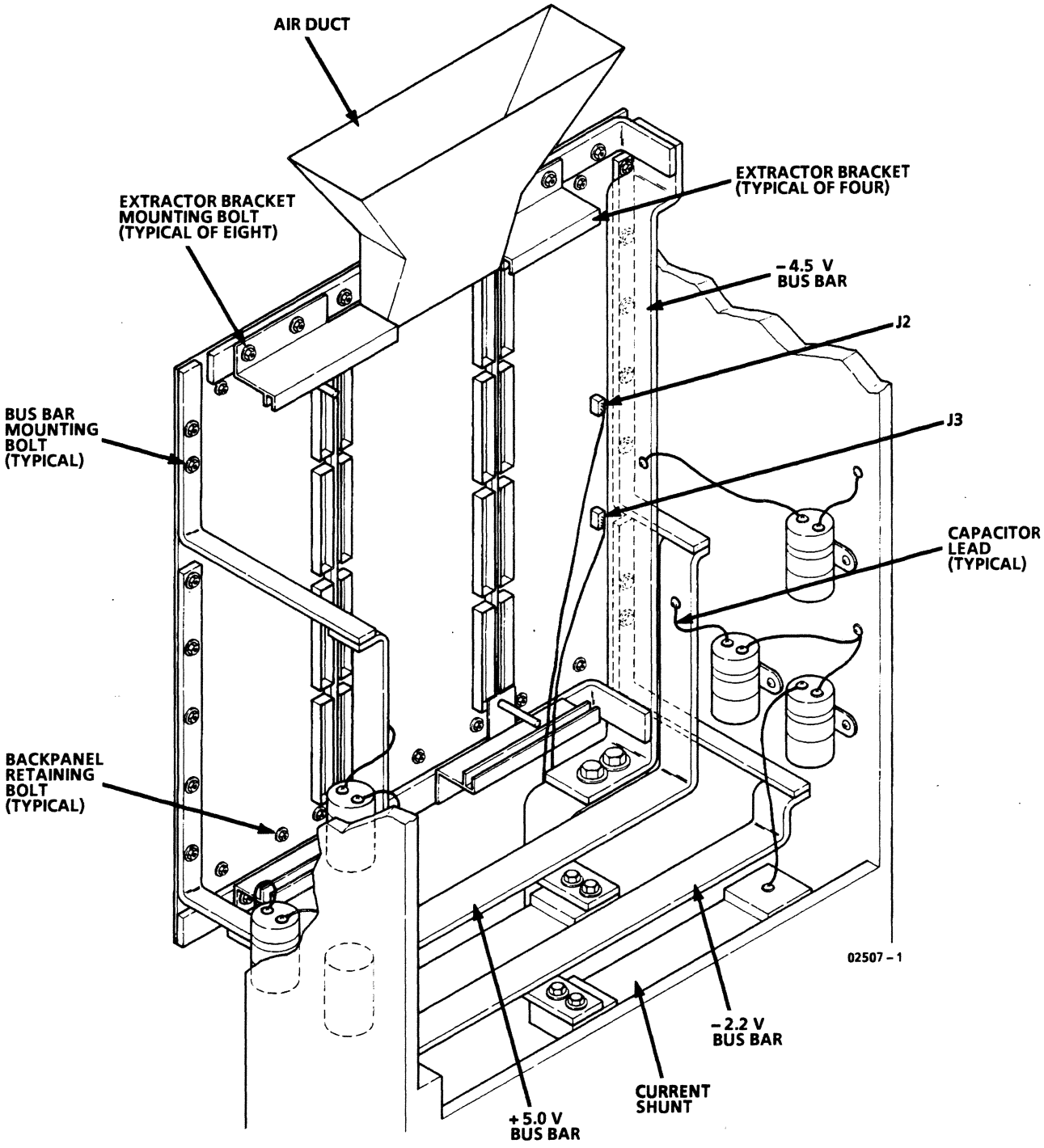


Figure 4-5. CM Backpanel

⚠CAUTION

When replacing control module, make sure module goes in as evenly as possible to prevent damage to pins.

___ 11. Remove control module from antistatic bag and position so guide pin openings are in the upper left and lower right corners and connector polarization notches face left (figure 4-6).

___ 12. Carefully center control module over guide pins and push in.

___ 13. Push extractor levers in, securely locking module.

___ 14. Tighten spring-loaded retaining screws on extractor levers.

___ 15. Using the source-destination labels on the hardware, connect all SIB cables, aligning cable polarization keys with connector polarization notches.

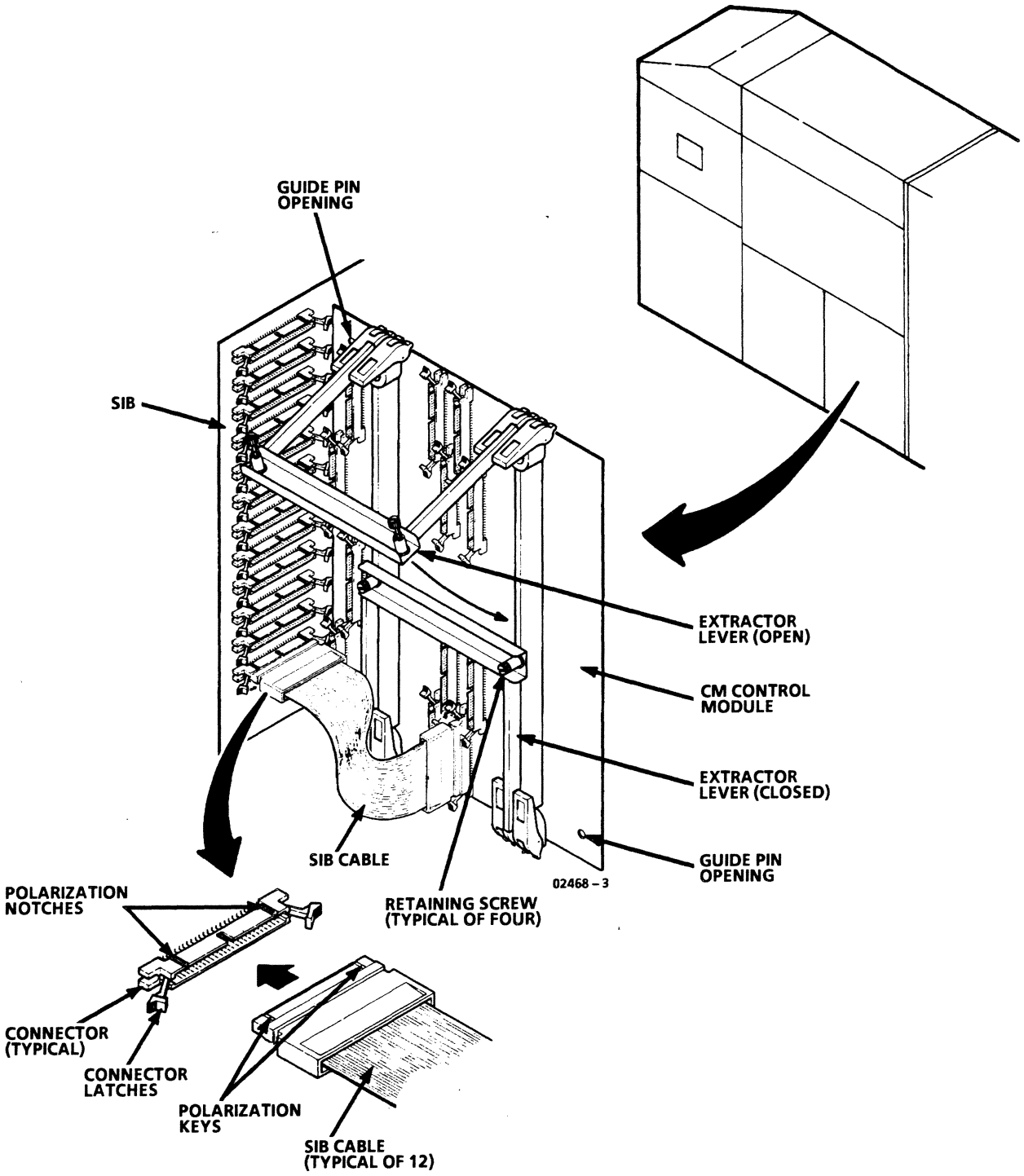


Figure 4-6. CM Control Module

___ 16. Remove one CM memory or regulator module from antistatic bag. Align module with components facing left in correct location of CM card cage (figure 4-7).

___ 17. Slide module into card cage and push evenly on module extractor levers to seat.

___ 18. Repeat steps 16 and 17 for all remaining modules.

___ 19. Replace CM card cage cover plate.

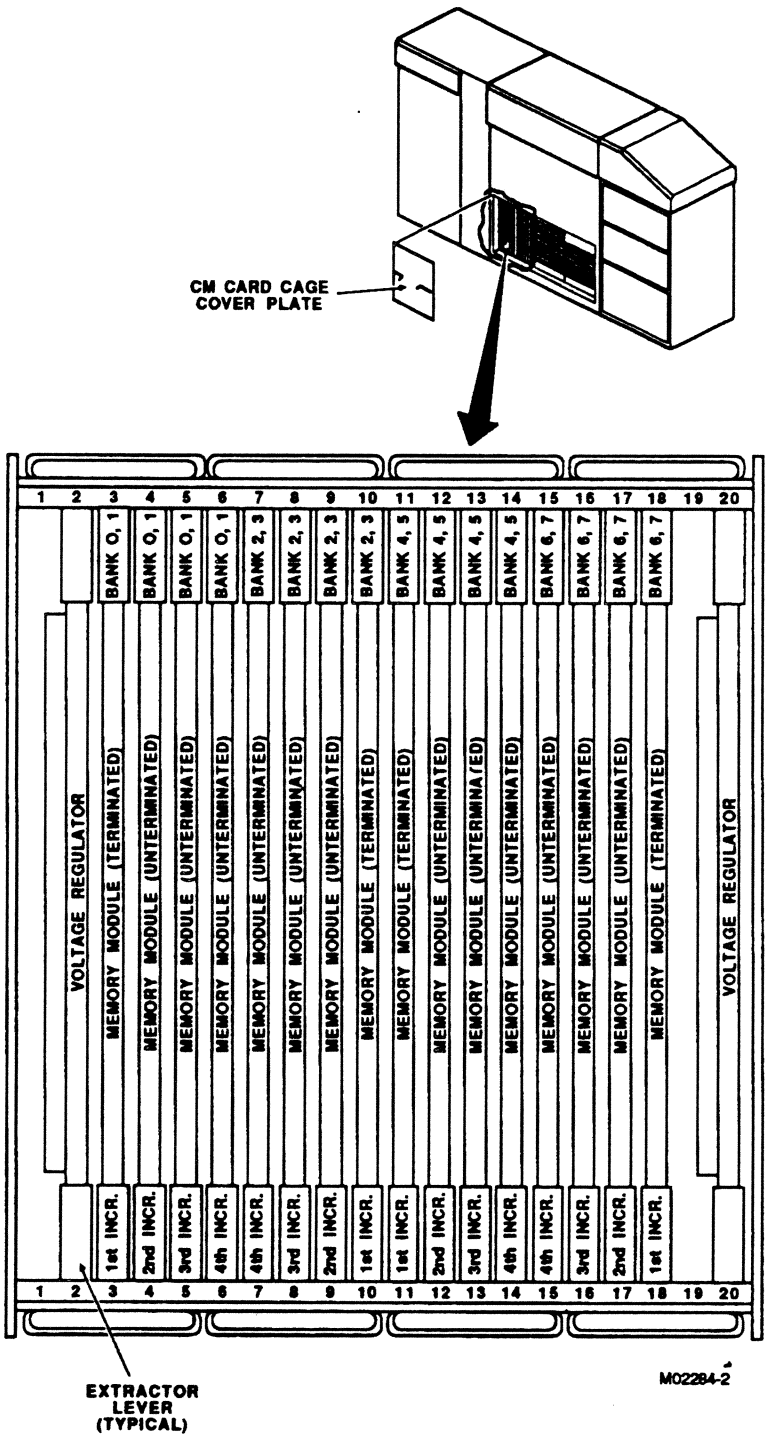


Figure 4-7. CM Card Cage

CM/CP Blower Assembly Removal and Replacement

Use this procedure to remove and replace the CM or CP blower assembly.

Tools/parts required

- Wrench, Allen, 5/16 in
- Screwdriver, Phillips
- Socket set, metric
- Nutdriver, 1/4 in
- Socket set, 3/8-in drive

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of the power unit to DISABLE and switching off 50/60- and 400-Hz power at the site source.

___ 2. Open cam latches on front and rear of CPU with Allen wrench (figure 4-8).

⚠WARNING

Two persons are required to lift muffler from CPU.

___ 3. Lift muffler from CPU.

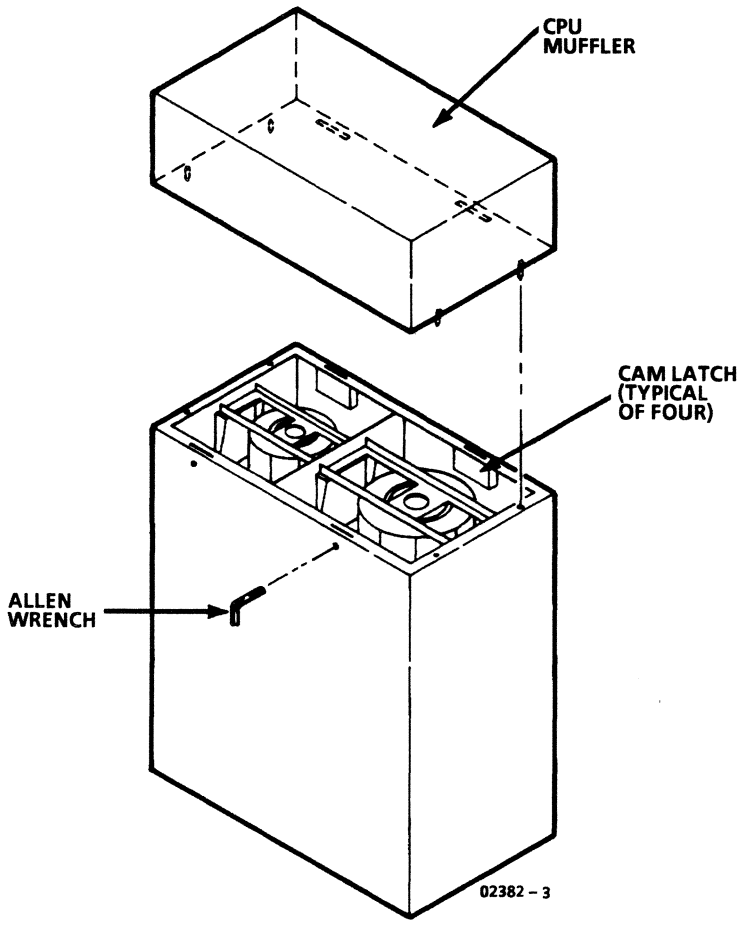


Figure 4-8. CPU Blower Muffler Removal

___ 4. Loosen quarter-turn pop screws on front panel of CPU blower box. Remove panel to allow horizontal access to blower assembly.

___ 5. Remove cable clamp from power cable (figure 4-9).

___ 6. Remove cover from power box. Disconnect power cable plug from power box receptacle.

___ 7. Remove ground strap from mounting bracket.

___ 8. Remove nuts holding mounting bracket to cabinet bracket.

___ 9. Lift blower assembly from cabinet and place in work area.

___ 10. Remove bolts holding blower to bracket, and remove bracket. Bracket is used to mount new blower.

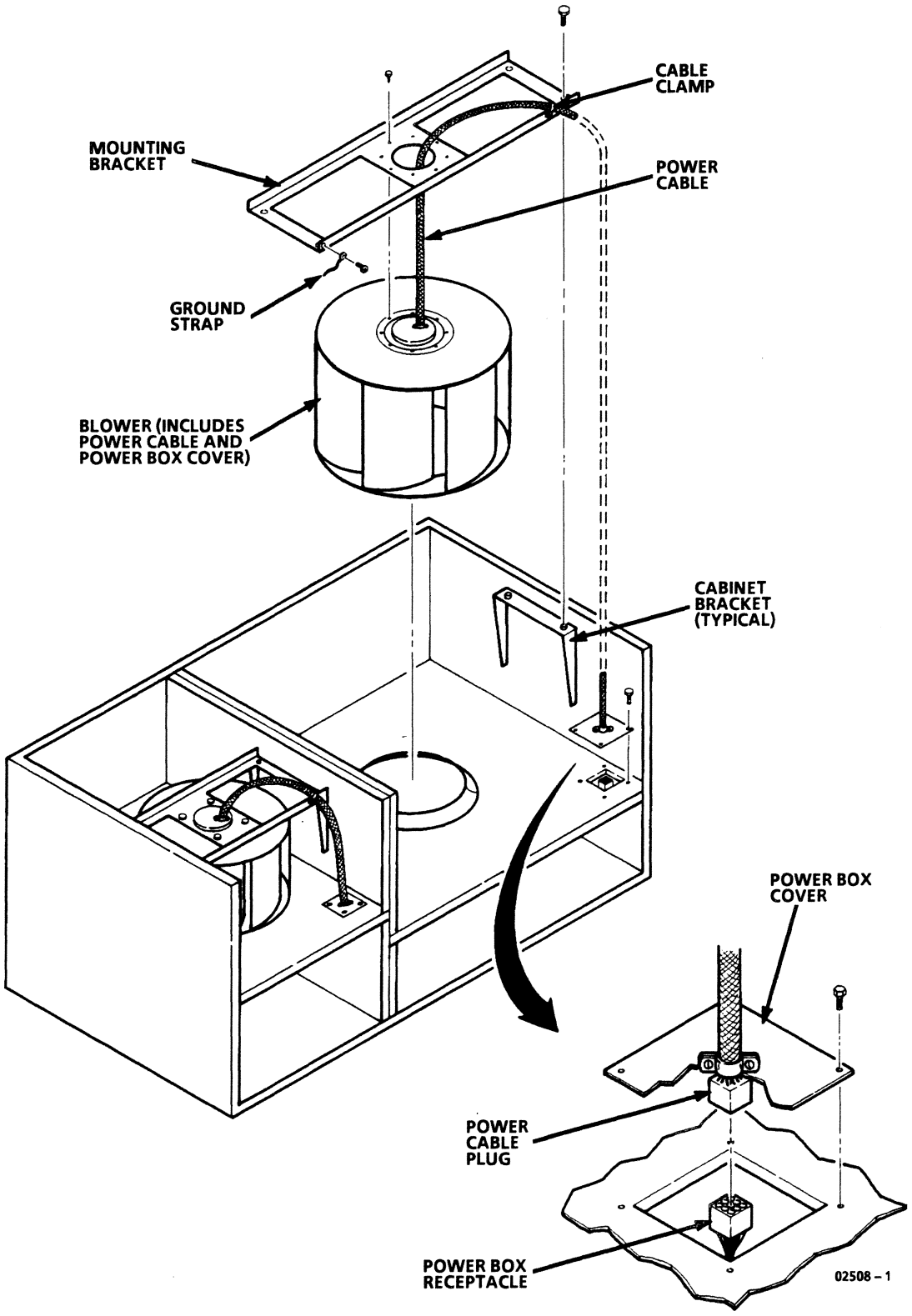


Figure 4-9. CM/CP Blower Assembly

Replacement

___ 1. Attach replacement blower to mounting bracket using bolts previously removed.

___ 2. Lift blower assembly into cabinet and set in place on shock mounting studs. Manipulate blower assembly until horizontal gap between inlet ring and blower is equal on both sides and blower wheel spins freely.

___ 3. Replace nuts and washers on mounting studs.

___ 4. Replace ground strap.

___ 5. Connect power wiring in power box. Replace power box cover.

___ 6. Replace cable clamp on power cable.

___ 7. Replace vertical panel of blower box and tighten quarter-turn pop screws.

⚠WARNING

Two persons are required to lift muffler into CPU.

___ 8. Set muffler on CPU with guide pins in guide pin holes (figure 4-10).

___ 9. Close cam latches on front and rear of CPU with Allen wrench.

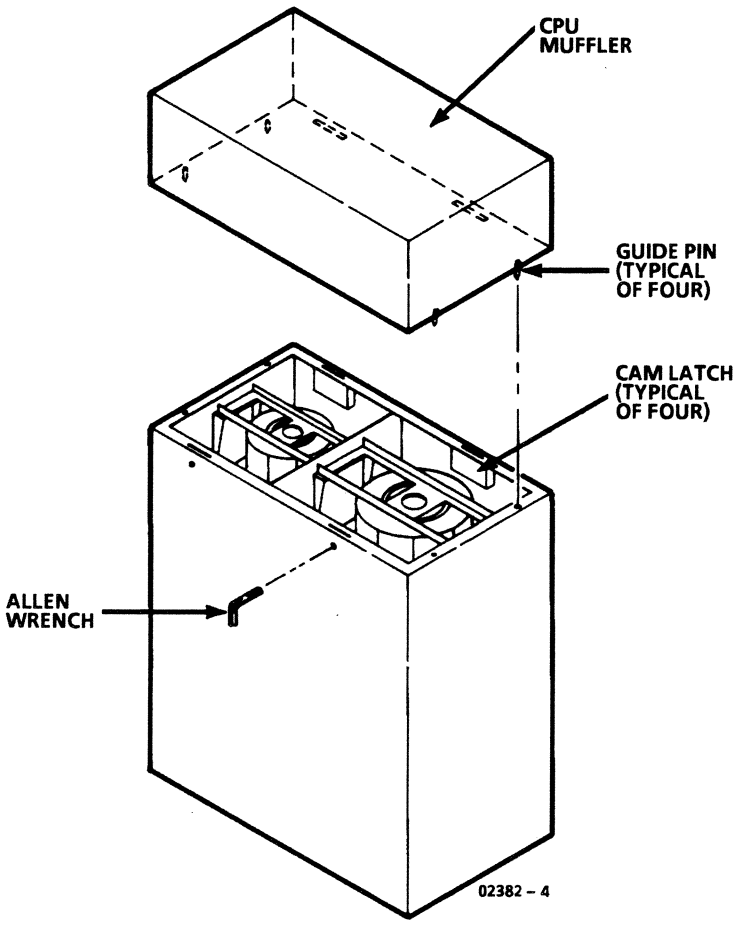


Figure 4-10. CPU Blower Muffler

CP Cage Removal and Replacement

Use this procedure to remove and replace either the CP-0 or the CP-1 logic cage.

Tools/parts required

- Wrist strap, antistatic
- Quick Release
- Bags, antistatic
- Nutdriver, 1/4 in, or Torx screwdriver set
- Covers, connector
- Gauge, connector alignment
- Pin straightener, connector

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Push button on end of Quick Release and insert into hole on end of left cam on top module (figure 4-11). Release button when Quick Release is fully inserted.

___ 4. Pull Quick Release and cam out until board interlock can be rotated into cam slot.

___ 5. Repeat steps 3 and 4 for right cam.

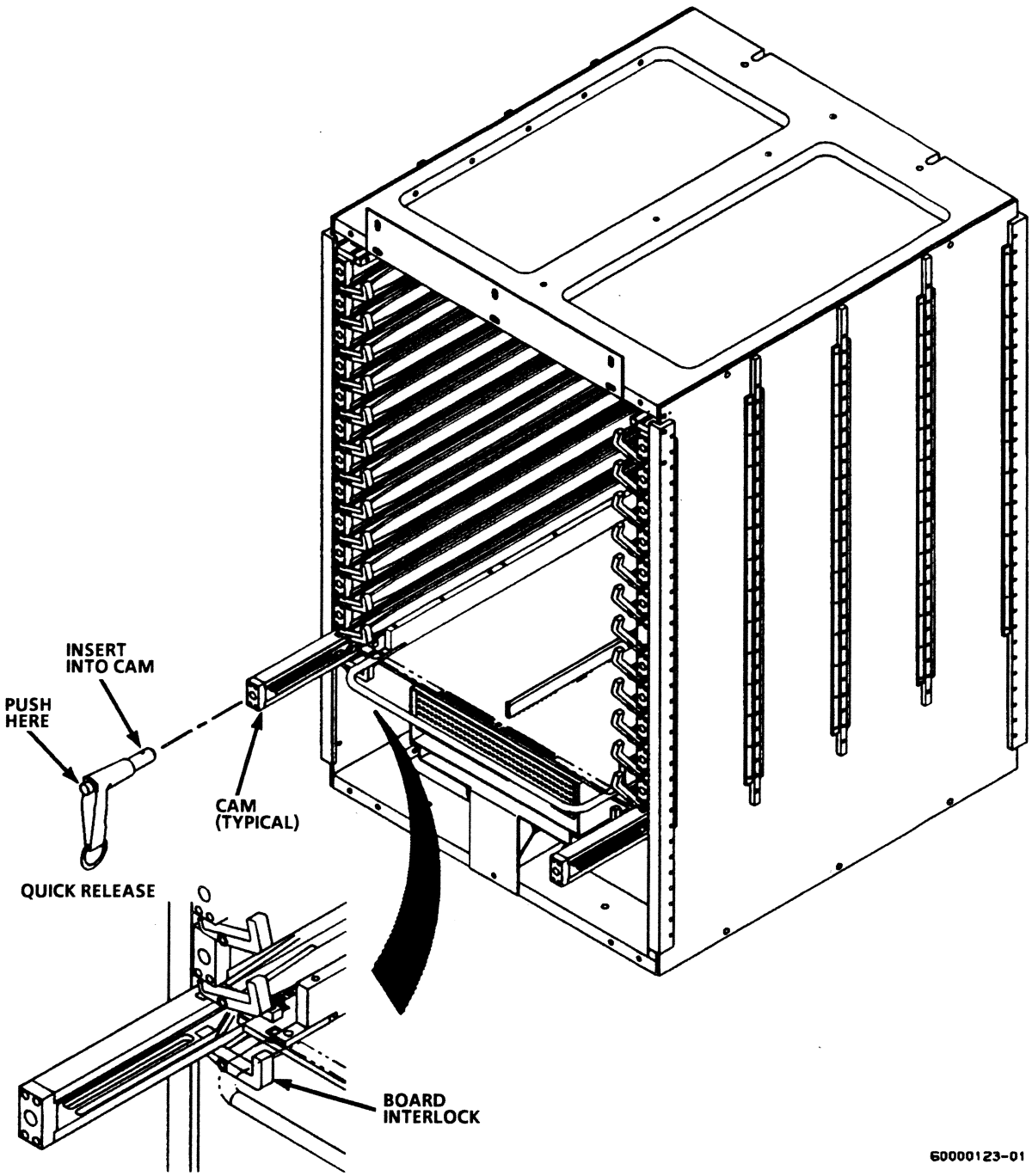


Figure 4-11. CP Cage

⚠CAUTION

When removing module, observe the underside of the module to be sure that any wires on the underside do not catch on anything below.

___ 6. Label, if necessary, and remove module by pulling evenly on module handle (figure 4-12). Support module underneath with free hand.

___ 7. Slide connector covers over the connectors on the logic module, then place module in antistatic bag and set aside.

___ 8. Repeat steps 3 through 7 for all remaining modules.

___ 9. Rotate board interlock out of left cam on top module. Use thumb or Quick Release to push cam into CP cage until fully seated.

___ 10. Repeat step 9 for remaining cams.

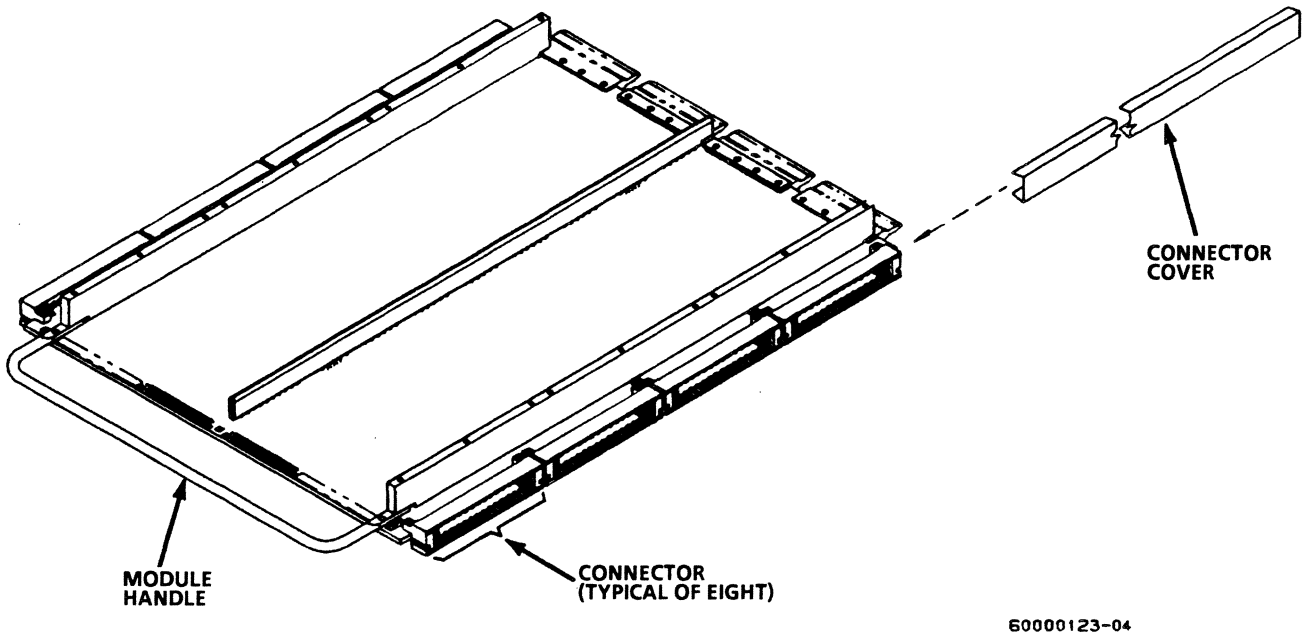


Figure 4-12. Logic Module

___ 11. If replacing CP-0, remove bolts from temperature sensor mounting bracket and place bracket out of the way (figure 4-13).

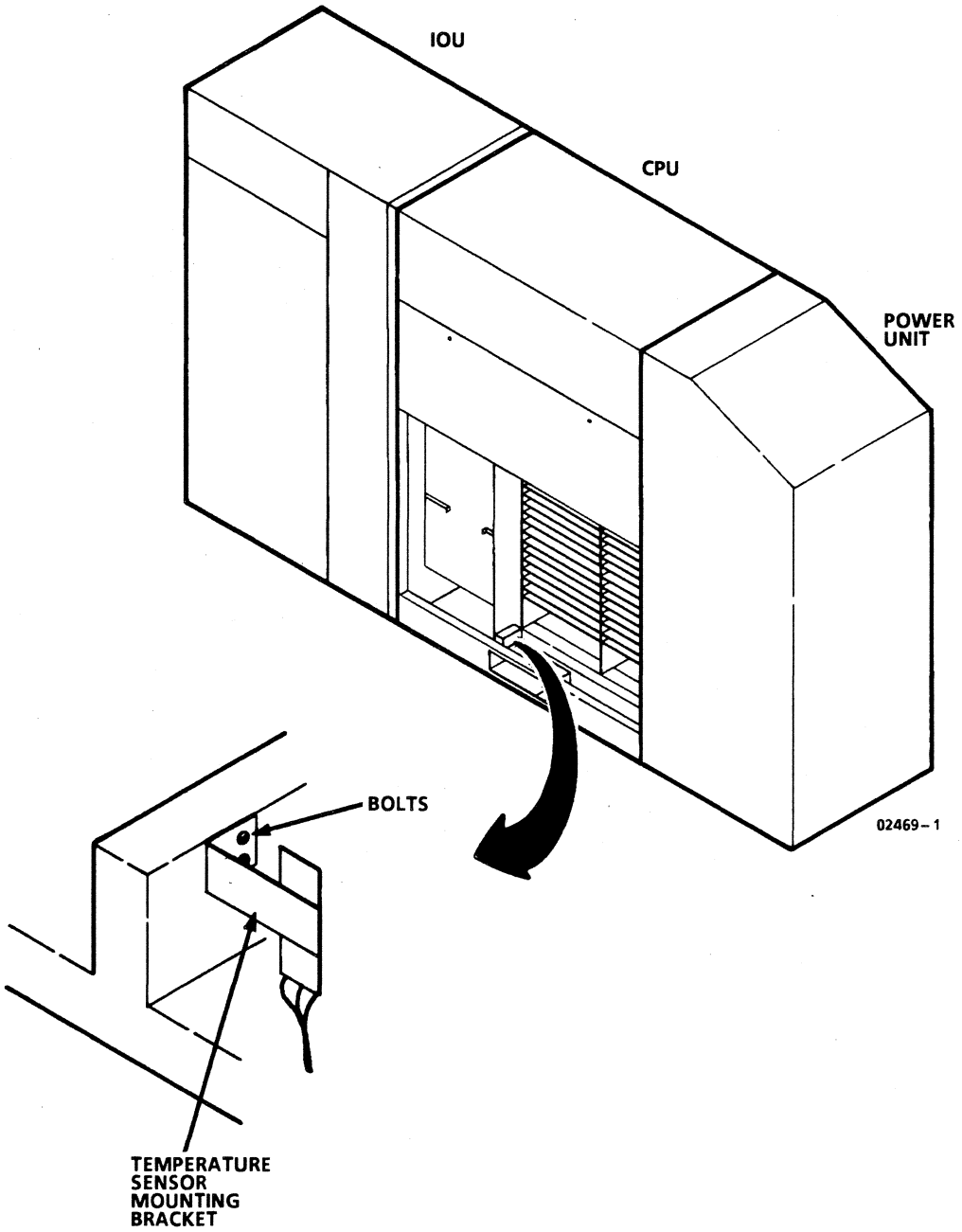


Figure 4-13. Temperature Sensor Location

___ 12. Label and remove J1 and J3 from front of regulator pak (figure 4-14).

___ 13. Remove regulator pak retaining screw.

___ 14. Slide out regulator pak and place in antistatic bag.

___ 15. Label SIB cables and remove by opening connector latches and pulling out cables.

___ 16. Place SIB cables in bottom of CP cabinet.

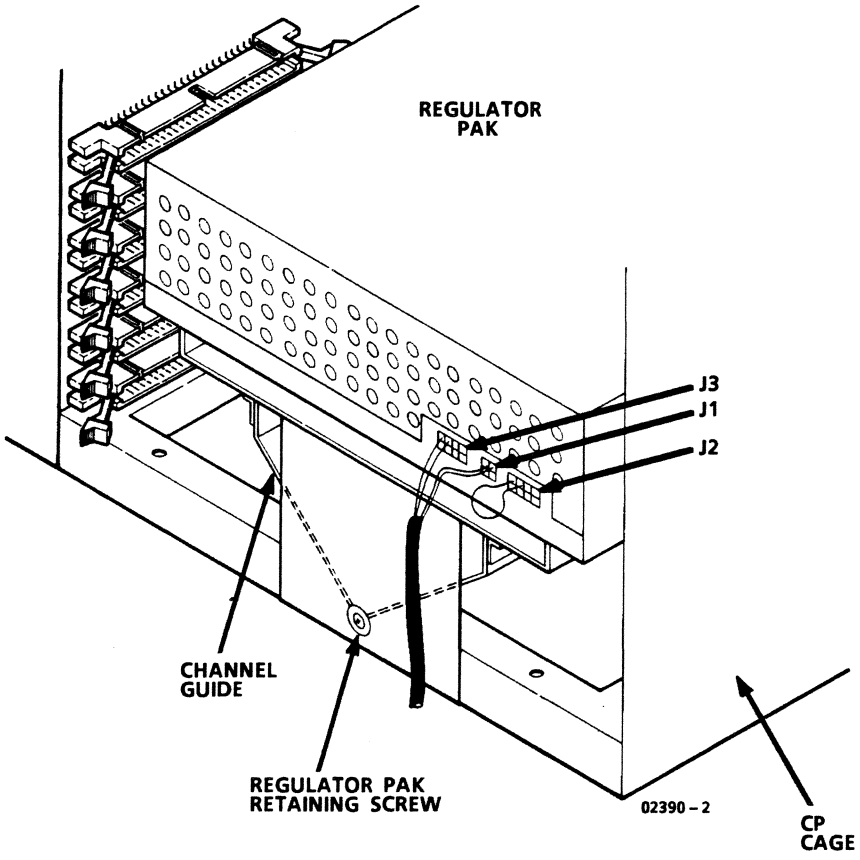


Figure 4-14. CP Regulator Pak

___ 17. If replacing CP-0, open CM rear door and open connector latches to release SIB cables plugged into SIB (figure 4-15).

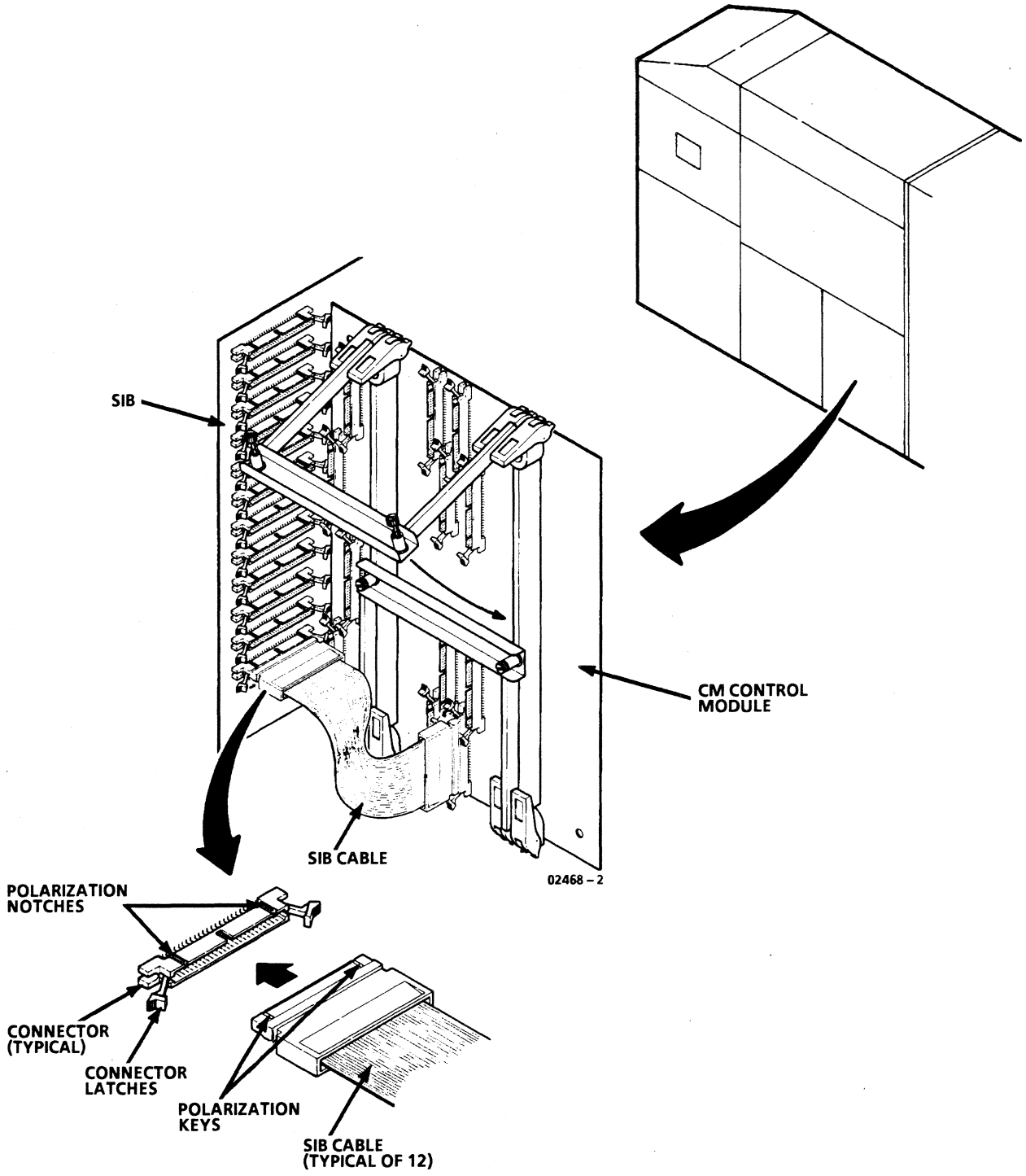


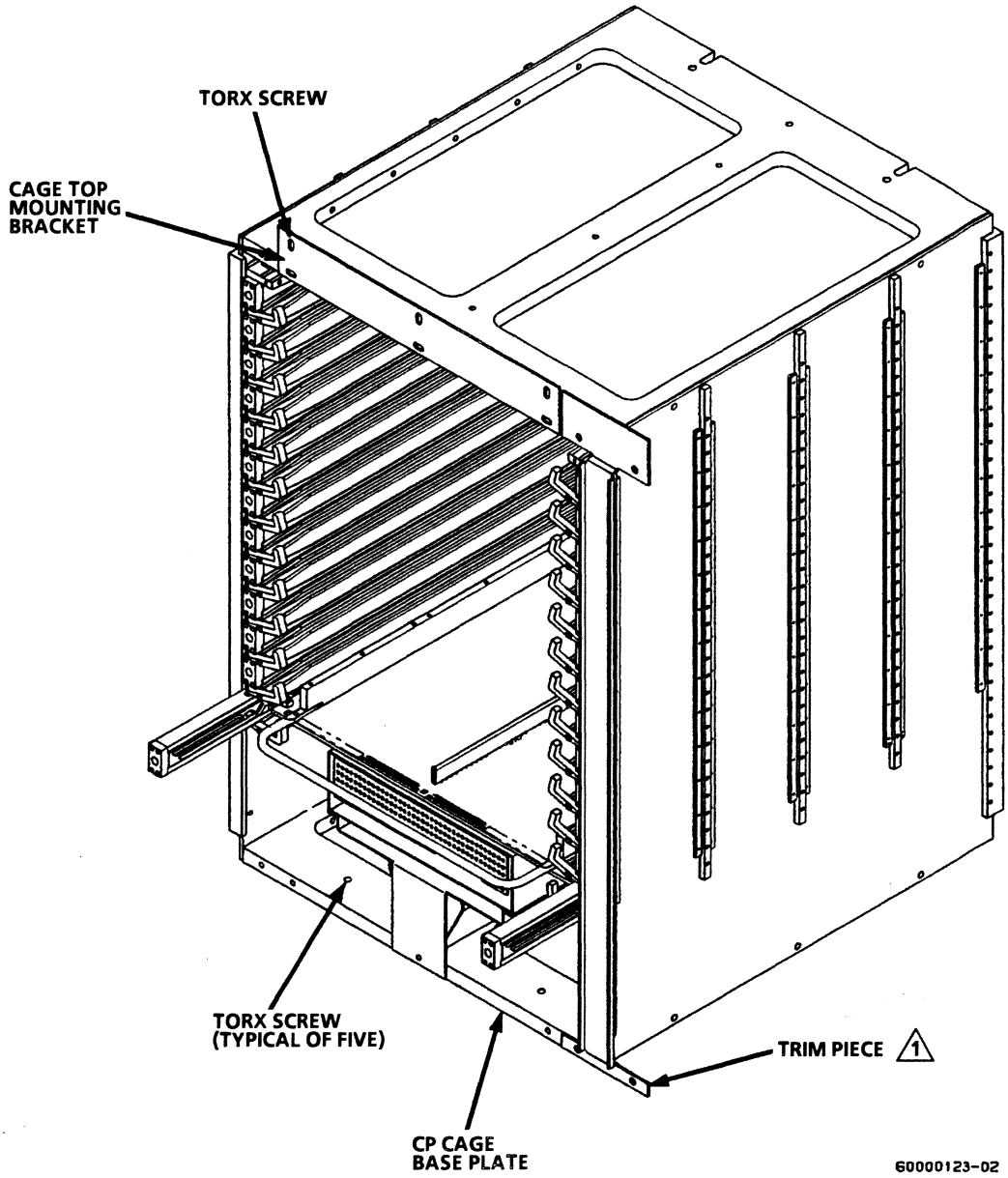
Figure 4-15. SIB to CM Cables

___ 18. Remove screws from CP cage base plate (figure 4-16).

___ 19. Remove upper screws that attach cage top mounting bracket to chassis so mounting bracket can be removed with CP cage.

___ 20. Remove screws from trim piece and remove trim piece from CP cage.

___ 21. Remove CP cage and set aside for return to factory.



NOTE:

1 TRIM PIECE IS LOCATED BETWEEN CP – 0 AND CP – 1.

Figure 4-16. CP Cage

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

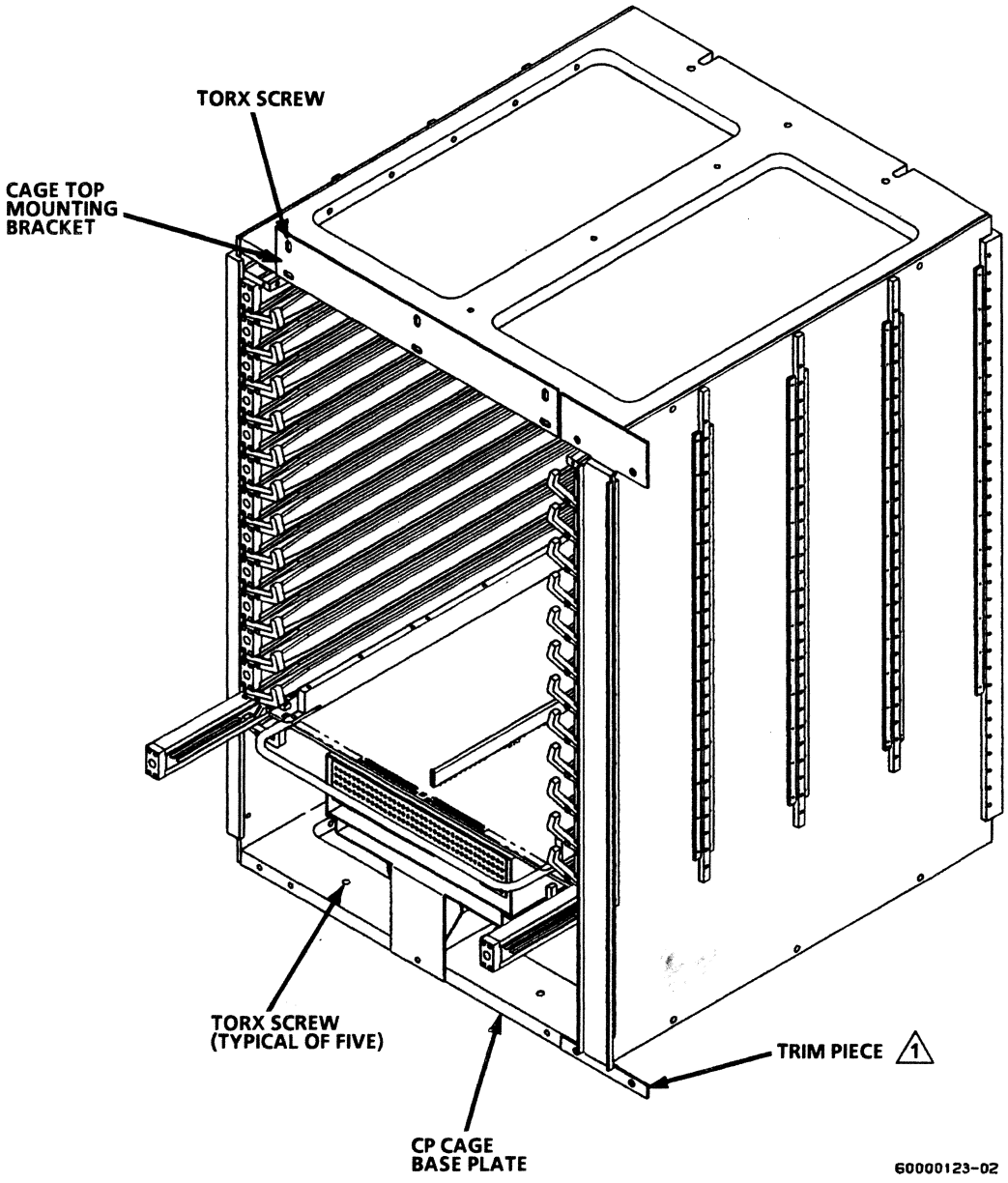
___ 2. Set CP cage into cabinet and slide back until CP cage base plate alignment slots slide into aligning pins (figure 4-17).

___ 3. Using a straightedge, align CP cage base plate so that edges of base plate are flush with frame of CPU.

___ 4. Replace screws in CP cage base plate.

___ 5. Replace screws in trim piece.

___ 6. Replace screws in cage top mounting bracket.



NOTE:

1 TRIM PIECE IS LOCATED BETWEEN CP – 0 AND CP – 1.

Figure 4-17. CP Cage

___ 7. Using the SIB connector map decals on the hardware, reconnect all SIB cables, aligning cable polarization keys with connector polarization notches (figure 4-18). If replacing CP-0, use source-destination labels on the hardware to reconnect SIB to CM cables.

___ 8. Remove regulator pak from antistatic bag, place on channel guide, and slide into logic cage until springy resistance is felt, then push regulator pak through resistance until it seats.

___ 9. Replace regulator pak retaining screw and J1 and J3. Do not remove J2.

___ 10. If replacing CP-0, replace temperature sensor mounting bracket and tighten bolts.

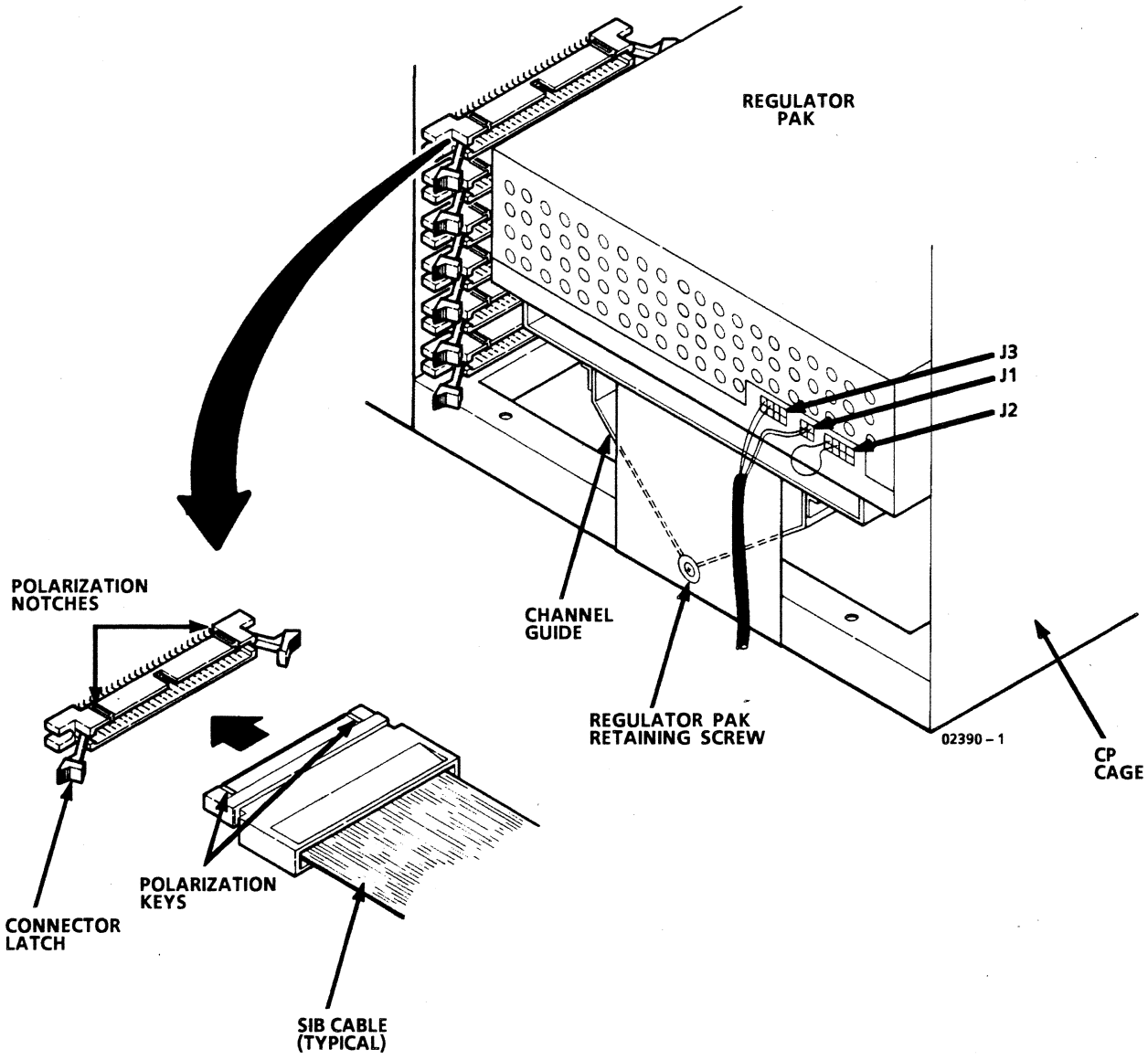


Figure 4-18. CP Regulator Pak

___ 11. Insert Quick Release into hole on end of left cam on top module. Pull cam out until board interlock can be rotated into cam slot (figure 4-19).

___ 12. Repeat step 11 for remaining cams.

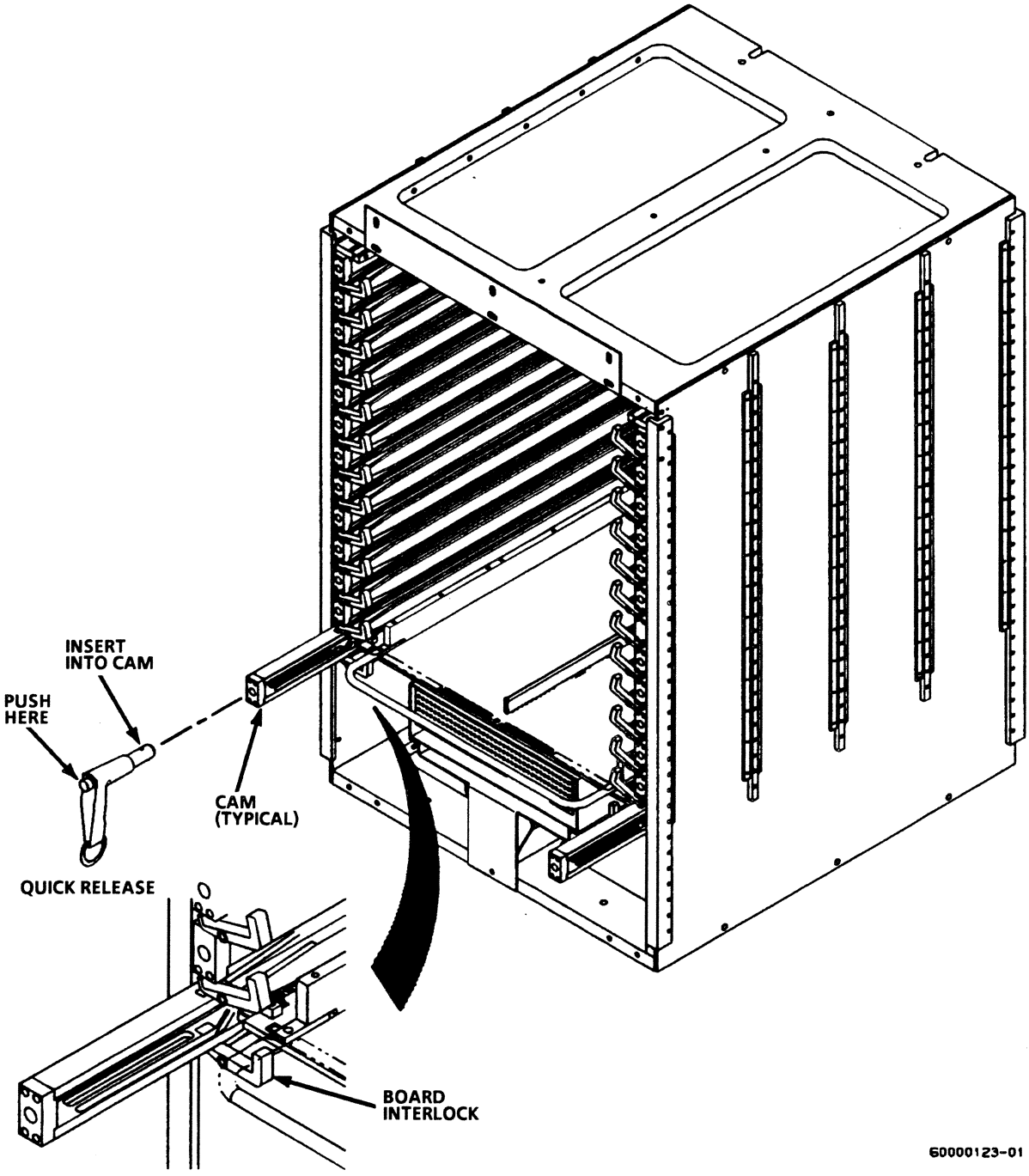


Figure 4-19. CP Cage

___ 13. Work from bottom to top when inserting modules. Remove bottom module from antistatic bag, remove connector covers, and slip connector alignment gauge over connectors to check for bent or broken pins. If alignment gauge does not slip easily over connectors, use pin straightener to straighten pins as necessary (figure 4-20).

⚠CAUTION

When replacing module, observe the underside of the module to be sure that any wires on the underside do not catch on anything below.

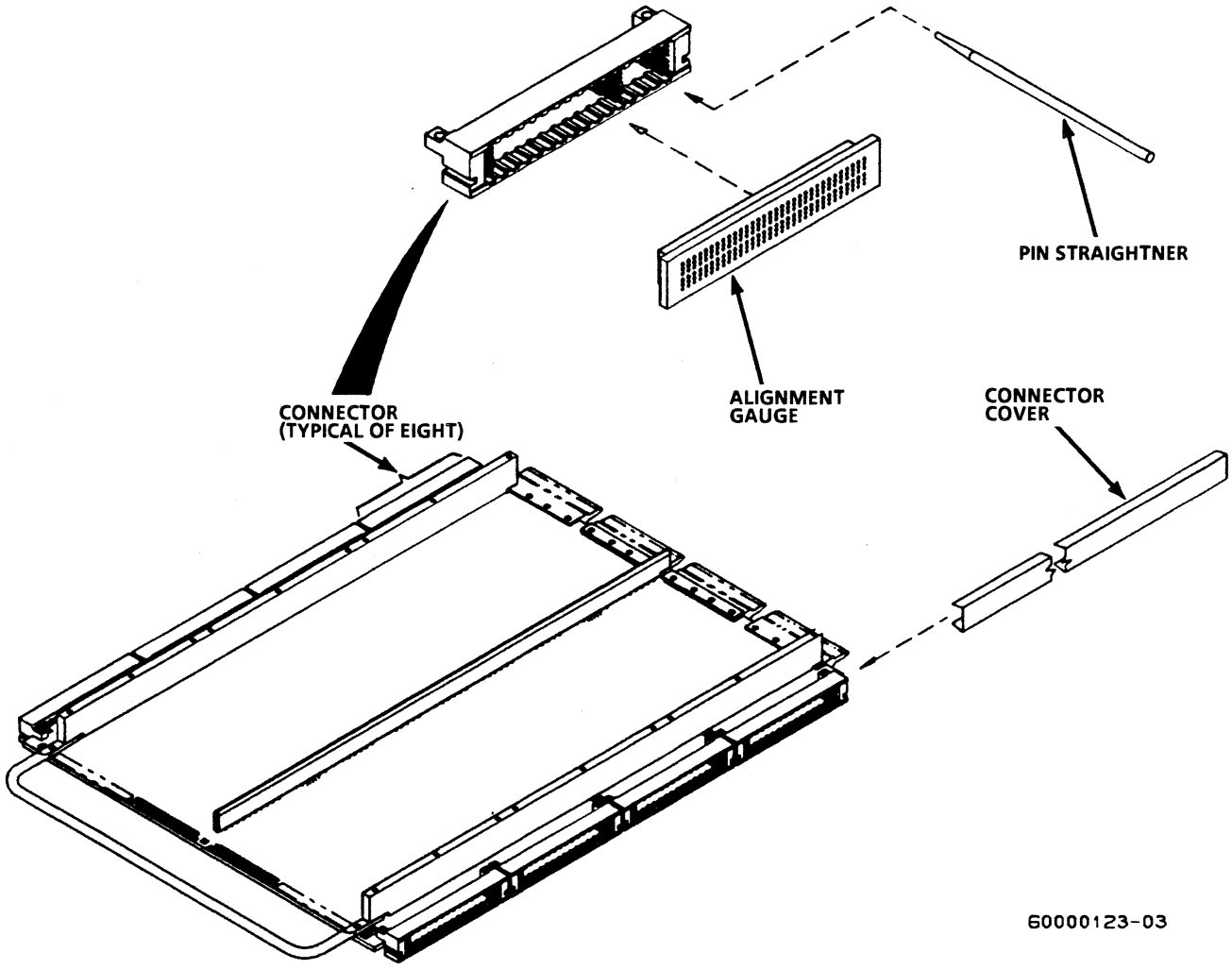


Figure 4-20. Logic Module

___ 14. Carefully center module and push into CP cage (figure 4-21) until springy resistance is felt, then push module through resistance until it seats with an audible "thud".

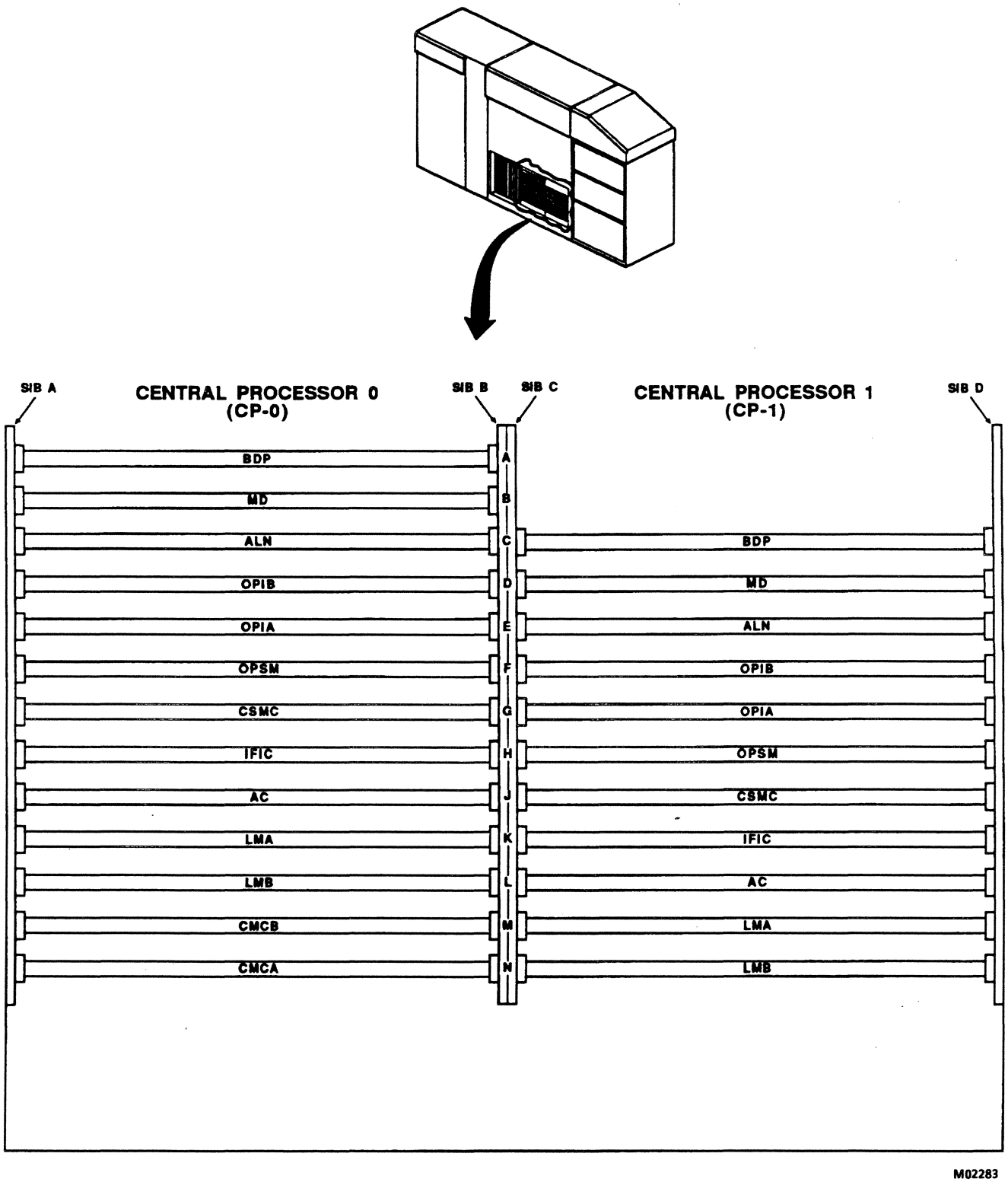


Figure 4-21. CP Module Locations

___ 15. Rotate board interlock out of left cam slot (figure 4-22). Use thumb or Quick Release to push cam into CP cage until fully seated.

⚠CAUTION

Do not force cams in. If cam binds or does not move relatively freely, pull cam out and push in again.

If cam still binds, pull both cams fully out, remove module; check for bent or broken pins; reseat; and push cams in again.

Do not attempt to clean cams or connectors with Freon, forced air, or any chlorinated solvent.

___ 16. Repeat step 15 for right cam.

___ 17. Repeat steps 13 through 16 for remaining CP modules.

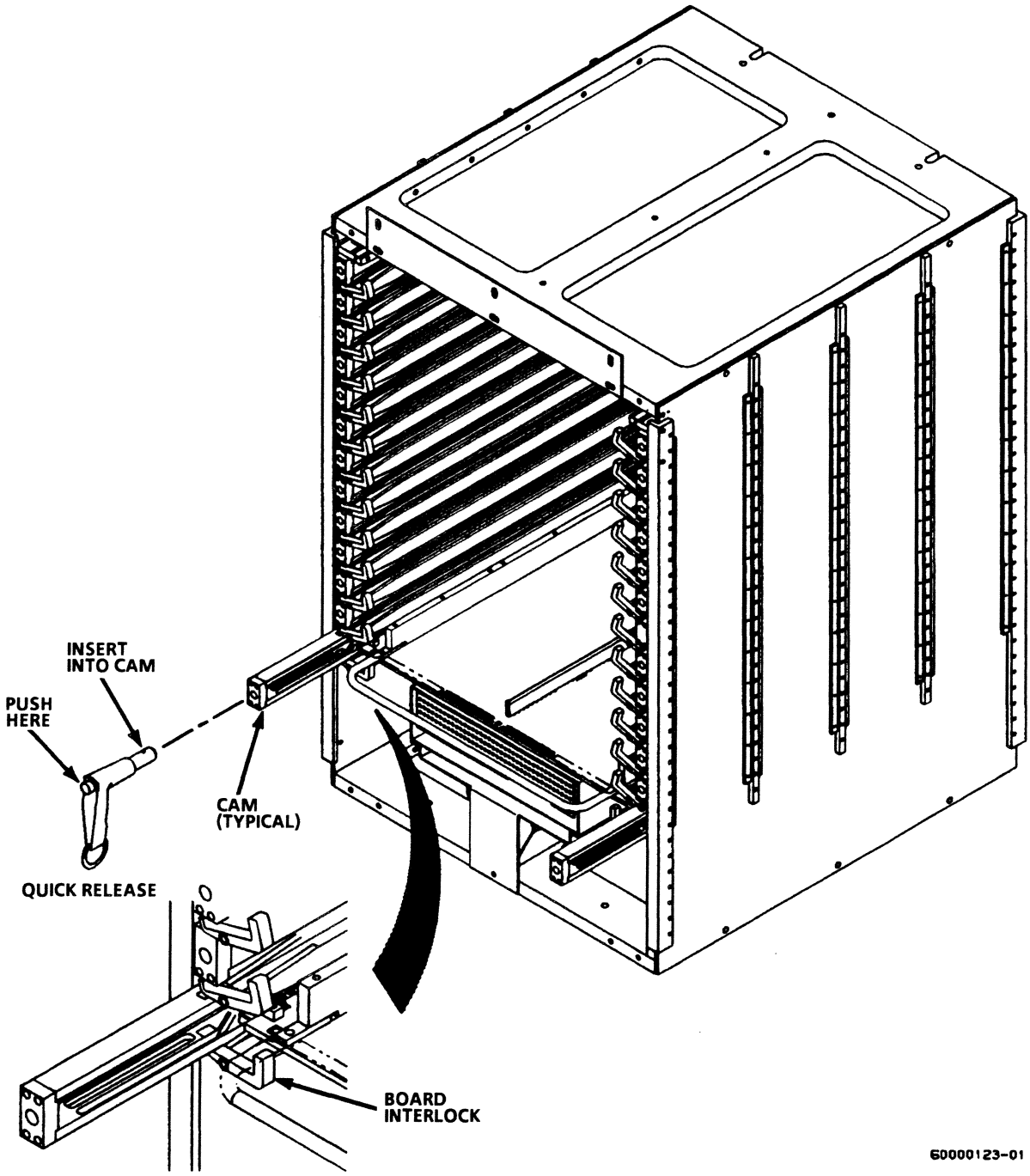


Figure 4-22. CP Cage

CM Control Module Removal and Replacement

Use this procedure to remove and replace the CM control module.

Tools/parts required

- Wrist strap, antistatic
- Bag, antistatic

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Open connector latches to release all SIB cables plugged into back of control module and place cables out of the way (figure 4-23).

___ 4. Loosen spring-loaded retaining screws on extractor levers.

⚠CAUTION

When removing and replacing control module, make sure the module goes in and out as evenly as possible to prevent damage to pins.

___ 5. Pull extractor levers back and out, releasing control module.

___ 6. Remove control module and place in antistatic bag.

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Remove control module from antistatic bag and position so guide pin openings are in the upper left and lower right corners and connector polarization notches face left.

___ 3. Center module over guide pins and push in.

___ 4. Push extractor levers in, securely locking module.

___ 5. Tighten spring-loaded retaining screws on extractor levers.

___ 6. Using source-destination labels on the hardware, connect all SIB cables to control module connectors, aligning cable polarization keys with connector polarization notches.

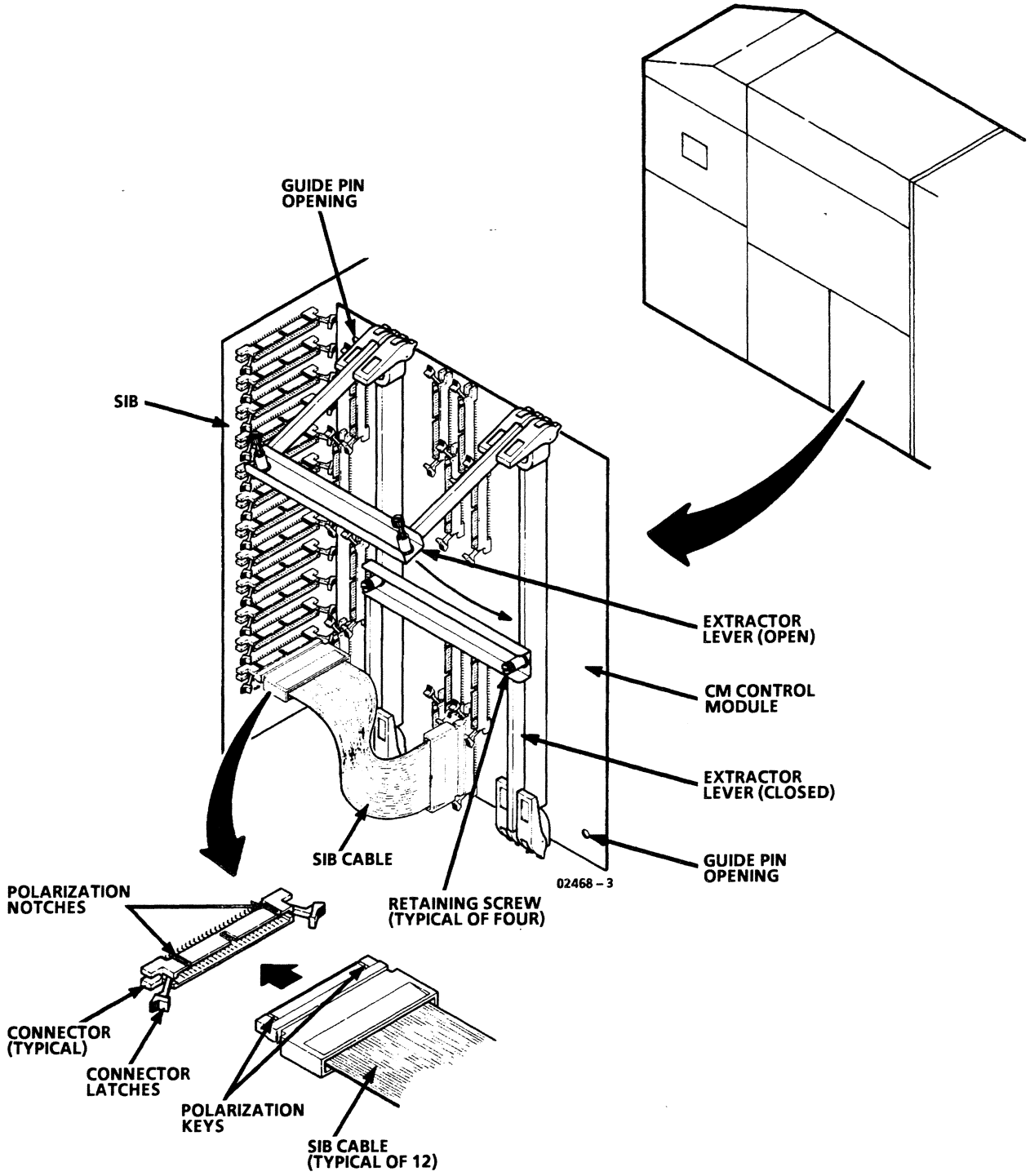


Figure 4-23. CM Control Module

CM Memory/Regulator Module Removal and Replacement

Use this procedure to remove and replace either CM modules or CM voltage regulator modules.

NOTE

When replacing voltage regulator modules, make sure that the position of the switch, S1, on the replacement module matches that of the old module. If there are eight or less CM modules, switch S1 should be in the C1 position. If there are more than eight CM modules, switch S1 is in the C2 position.

Tools/parts required

- Wrist strap, antistatic
- Bag, antistatic

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Remove CM logic cage cover plate (figure 4-24).

___ 4. Locate module to be removed and pull on upper and lower extractor levers at the same time to release module.

___ 5. Remove module from CM logic cage and place in antistatic bag.

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Remove module from antistatic bag, align module in guide rails with components facing left, and slide into logic cage.

___ 3. Push on module extractor levers to seat module.

___ 4. Replace CM logic cage cover plate.

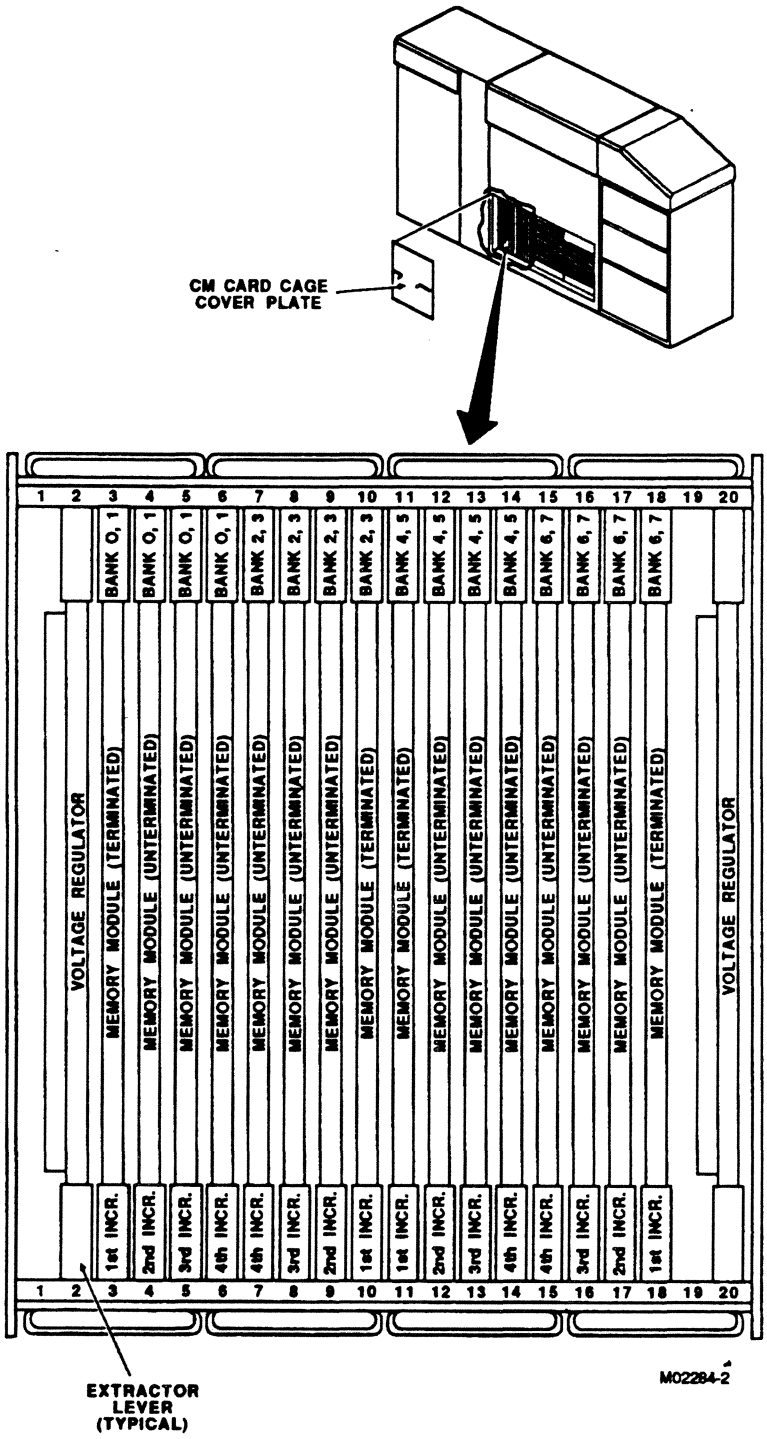


Figure 4-24. CM Memory/Regulator Module

CP Module Removal and Replacement

Use this procedure to remove and replace the following logic modules in CP-0 and/or CP-1.

AC, ALN, BDP, CSTMAC, IFIC, LMA, LMB, MD, OPIA, OPIB, OPISM, CMCA, CMCB.

Tools/parts required

- Wrist strap, antistatic
- Quick Release
- Bag, antistatic
- Covers, connector
- Gauge, connector alignment
- Pin straightener, connector

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Locate module designated for removal/replacement (figure 4-25).

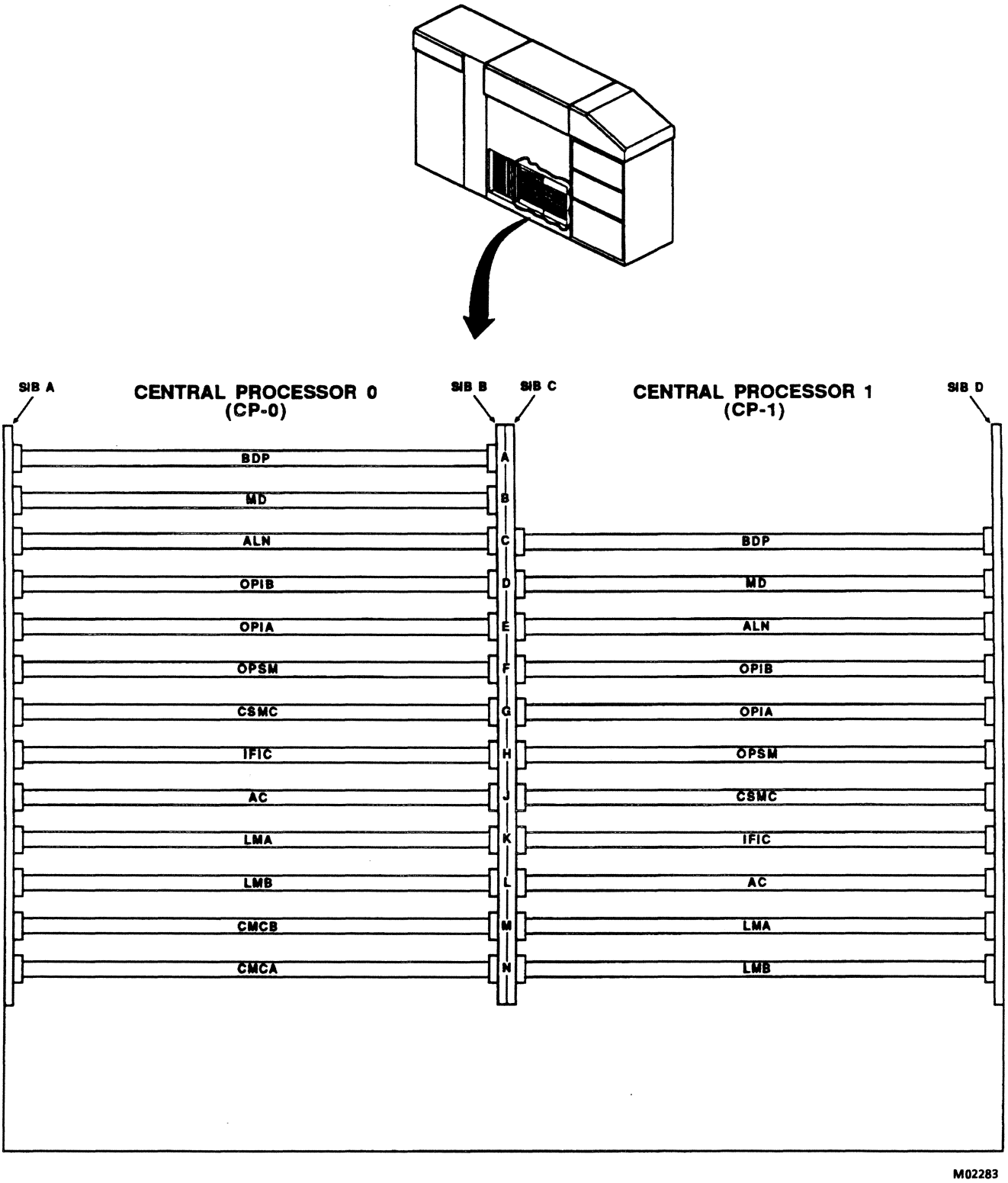


Figure 4-25. CP Module Locations

___ 4. Push button on end of Quick Release and insert into hole on end of left cam corresponding to module designated for removal/replacement. Release button when Quick Release is fully inserted.

___ 5. Pull Quick Release and cam out until board interlock can be rotated into cam slot (figure 4-26).

___ 6. Repeat steps 3 and 4 for right cam.

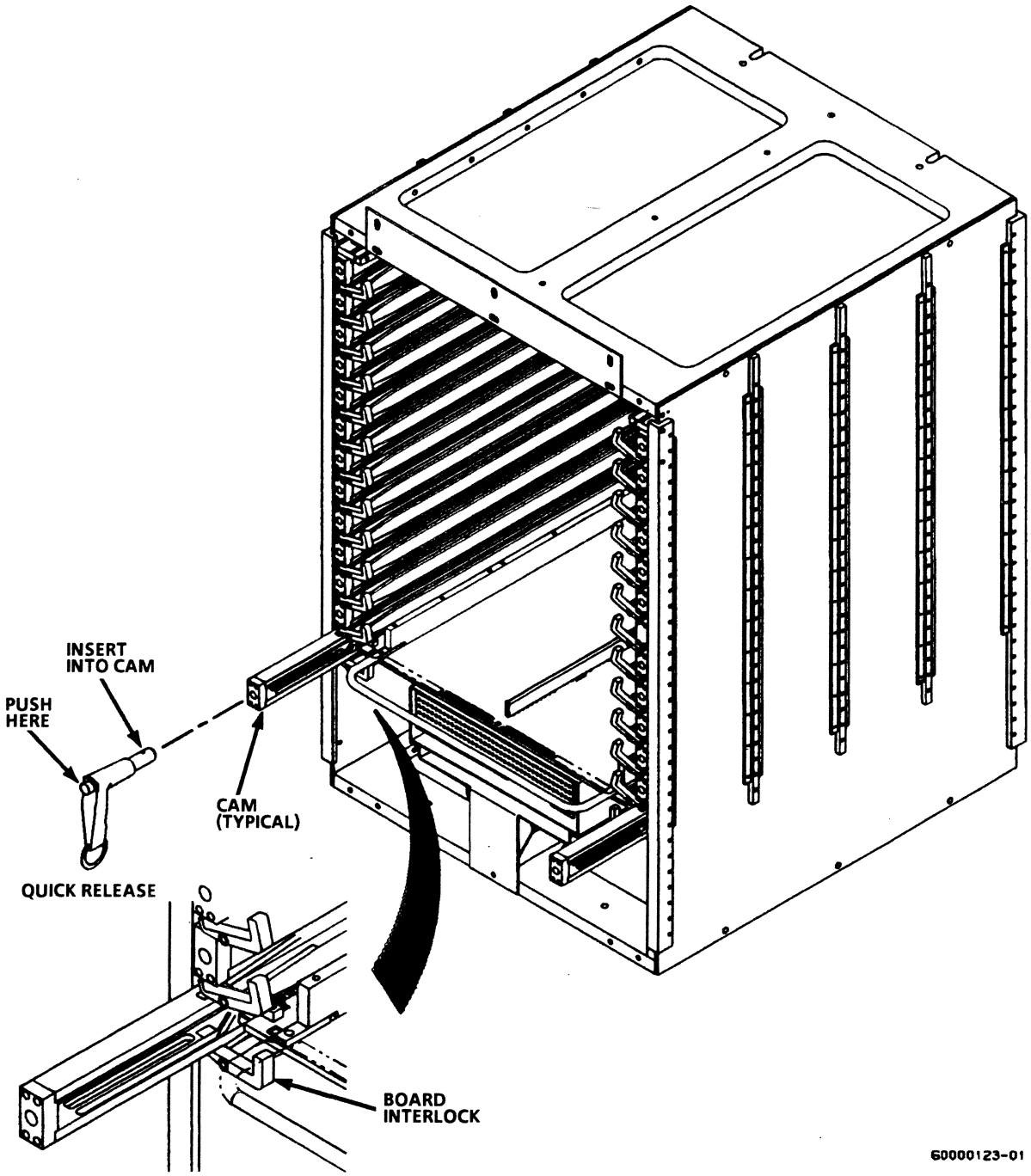


Figure 4-26. CP Cage

⚠CAUTION

When removing module, observe the underside of the module to be sure that any wires on the underside do not catch on anything below.

___ 7. Remove module (figure 4-27) by pulling evenly on module handle. Support module underneath with free hand.

___ 8. Slide connector covers over connectors on logic module, then place module in antistatic bag and set aside.

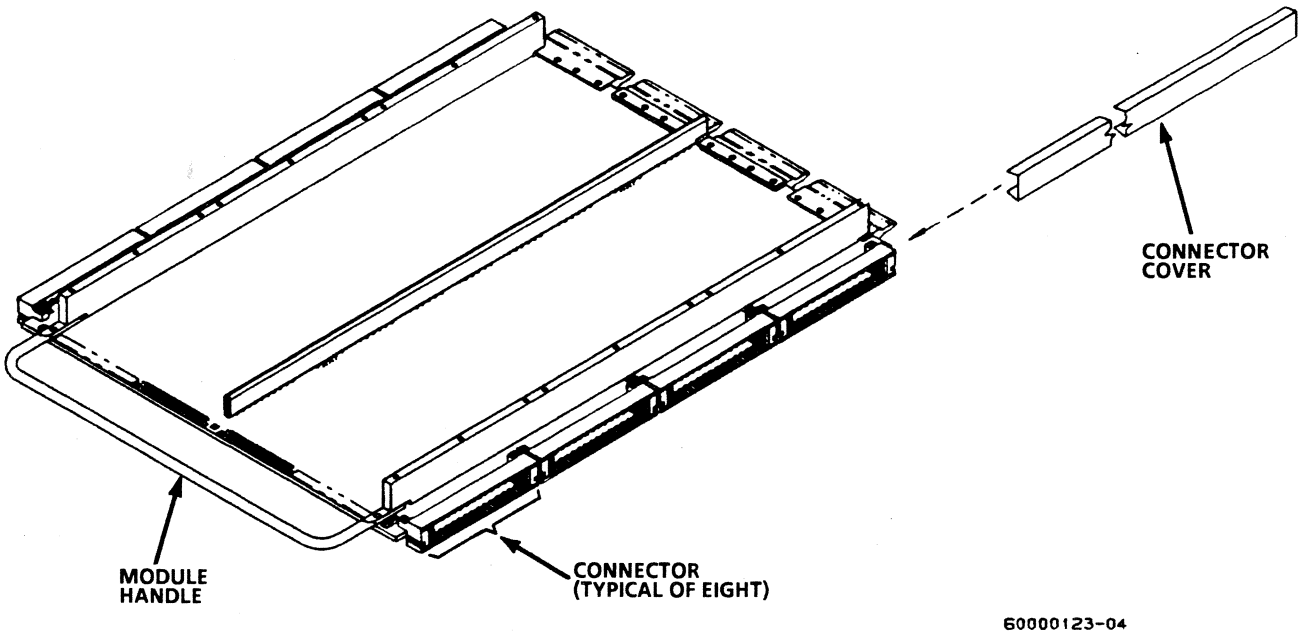


Figure 4-27. Logic Module

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Remove module from antistatic bag, remove connector covers, and slip connector alignment gauge over connectors to check for bent or broken pins (figure 4-28). If alignment gauge does not fit over connectors, use pin straightener to straighten pins as necessary.

CAUTION

When replacing module, observe the underside of the module to be sure that any wires on the underside do not catch on anything below.

___ 3. Carefully center module and push into CP cage until springy resistance is felt, then push module through resistance until it seats with an audible "thud."

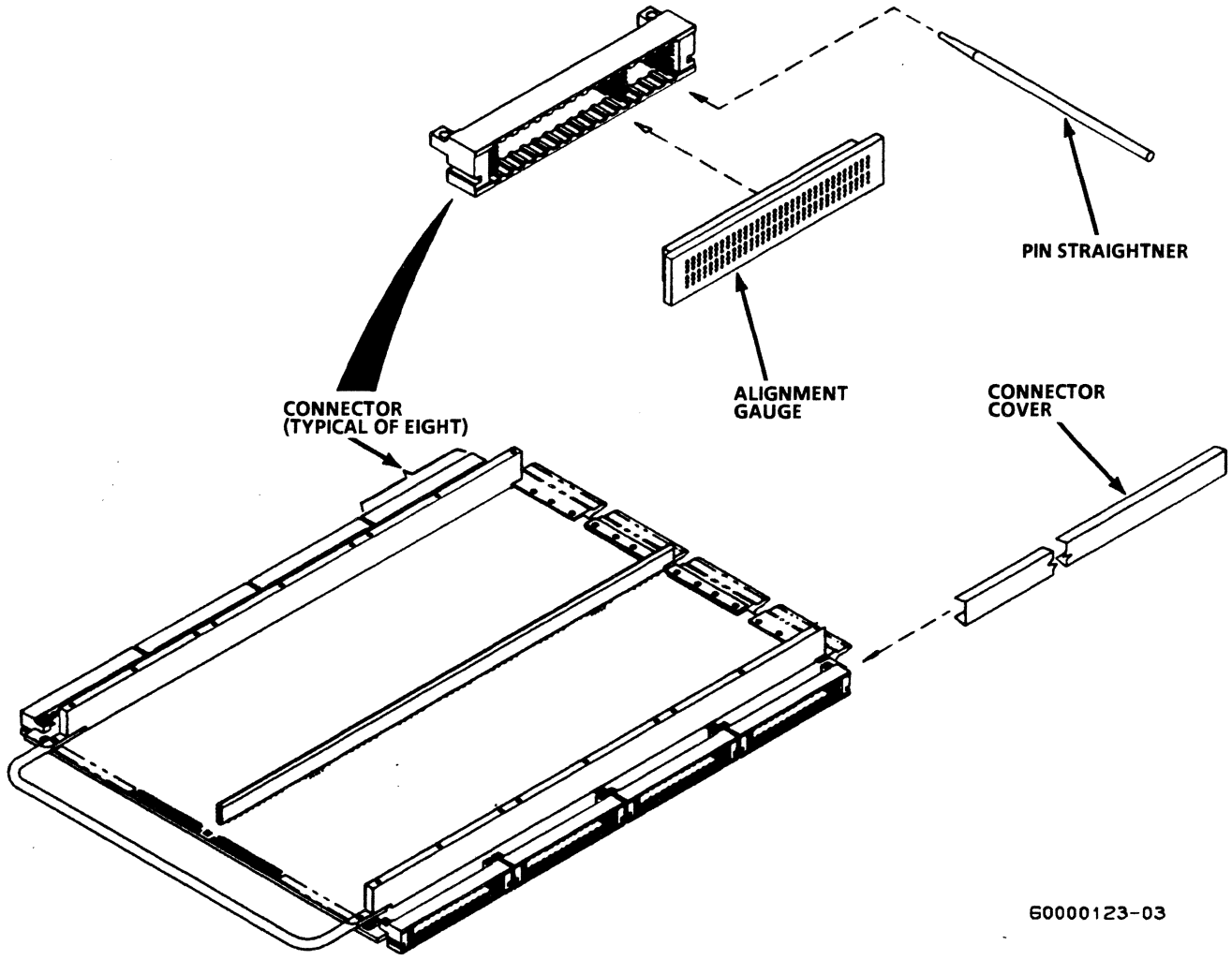


Figure 4-28. Logic Module

___ 4. Rotate board interlock out of left cam slot (figure 4-29). Use thumb or Quick Release to push cam into CP cage until fully seated.

⚠CAUTION

Do not force cams in. If cam binds or does not move relatively freely, pull cam out and push in again.

If cam still binds, pull both cams fully out, remove module; check for bent or broken pins; reseat; and push cams in again.

Do not attempt to clean cams or connectors with Freon, forced air, or any chlorinated solvent.

___ 5. Repeat step 4 for right cam.

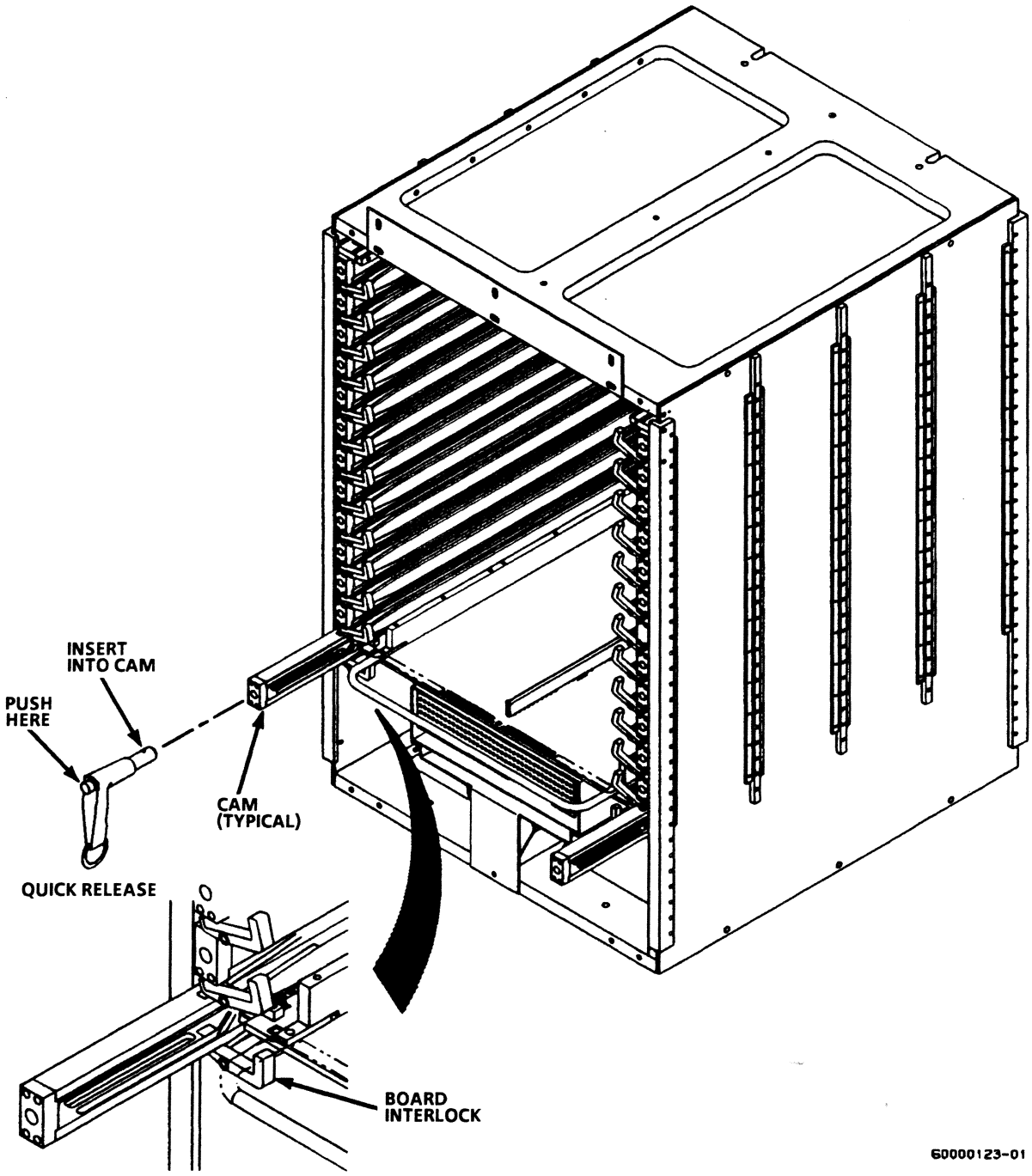


Figure 4-29. CP Cage

CP Regulator Pak Removal and Replacement

Use this procedure to remove and replace the CP regulator pak. The regulator pak is located at the bottom of the card cage, and is attached to the channel guide.

Tools/parts required

- Wrist strap, antistatic
- Nut driver, 1/4 in, or Torx screwdriver set
- Bag, antistatic

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Label J1 and J3 and remove from front of regulator pak (figure 4-30).

___ 4. Remove regulator pak retaining screw.

___ 5. Slide regulator pak out and place in antistatic bag.

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Remove regulator pak from antistatic bag, place on channel guide, and slide into logic cage until springy resistance is felt, then push regulator pak through resistance until it seats.

___ 3. Replace regulator pak retaining screw.

___ 4. Connect J1 and J3 to front of regulator pak.

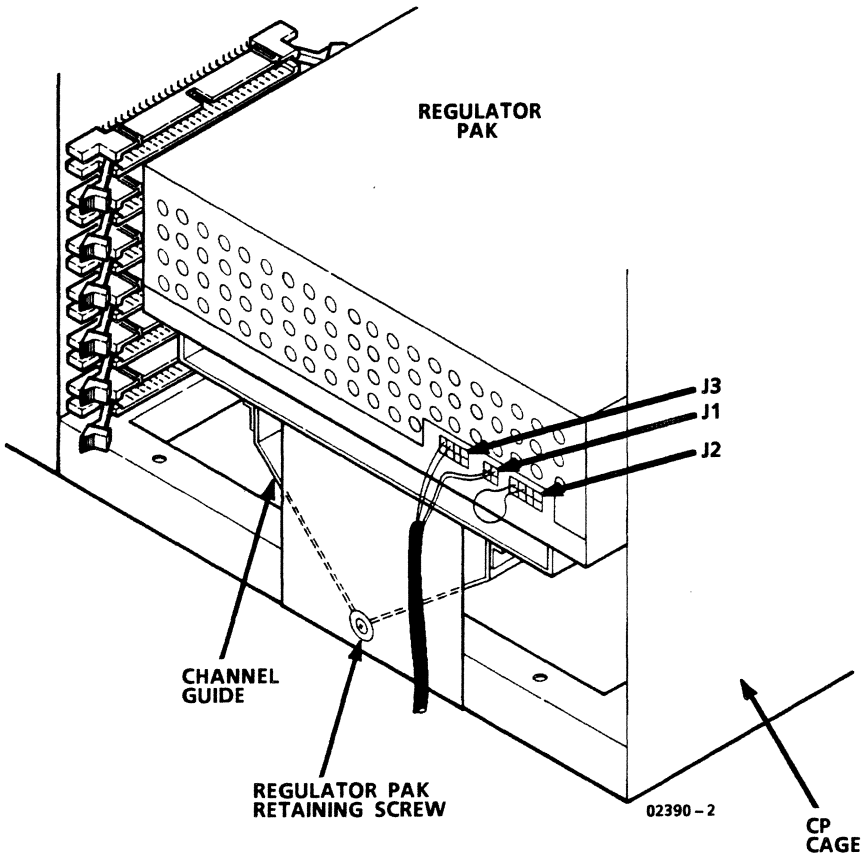


Figure 4-30. CP Regulator Pak

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SIB Cable Removal and Replacement

Use these procedures to remove and replace SIB cables. This section is divided into two parts. The first part contains general information and the second part contains the removal and replacement procedures for SIB cables with differing destinations.

General Information

The cables used in the CYBER 960/962 system originate at the side interconnect boards (SIBs) located on the insides of the CP cage(s) below the logic modules. A single CP system has two SIBs, SIB A and SIB B. A dual-CP system has two additional SIBs, SIB C and SIB D (figure 4-31).

Three cable types originate at the SIBs located on the insides of the CP cage(s):

- SIB to IOU
- SIB to SIB
- SIB to Power Unit

The fourth, the SIB to CM control module cable, originates on the rear outside of CP-0.

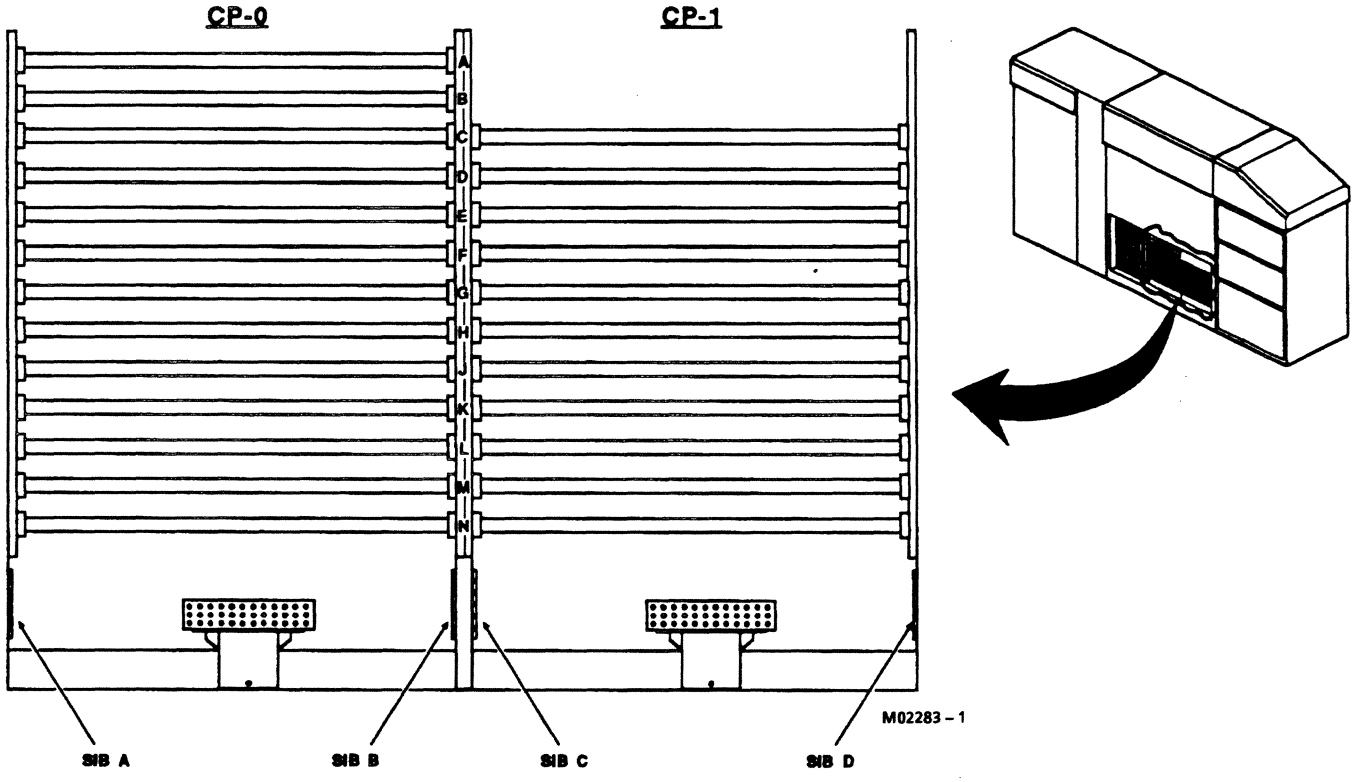

Figure 4-31. CPU SIB Locations

Shorting plugs are located on SIBs A and C in the unblanked positions shown in figure 4-32. They are not covered in a removal/replacement procedure but are included in the parts list as a field-replaceable unit. Changing shorting plugs is just a matter of opening the connector latches to release the defective plug and connecting the new plug.

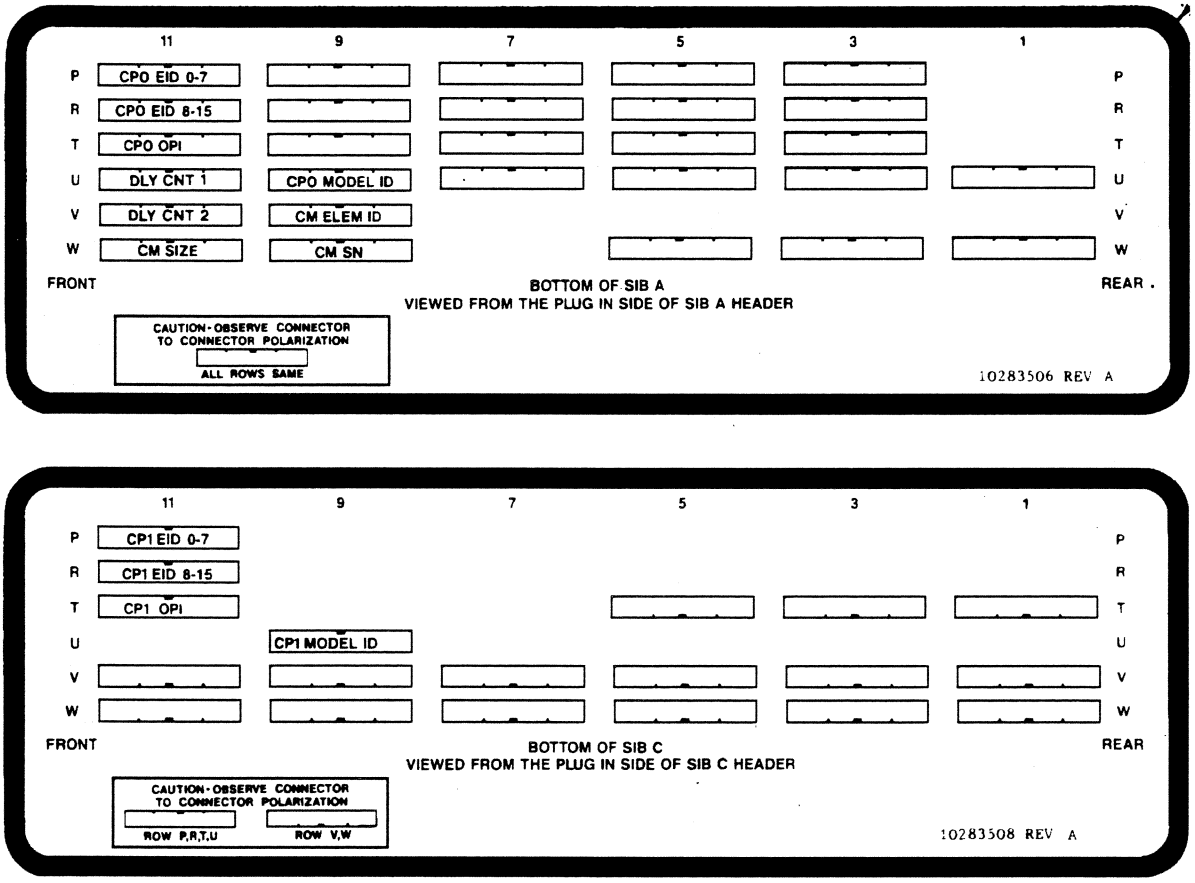

Figure 4-32. Shorting Plug Locations

All cables are the same on both ends. The SIB to CM cable labeled MEM P2 on both ends plugs into C02 on the outside of SIB A and into C02 on the CM control module. Similarly, the SIB to IOU cable labeled P78 on both ends plugs into IOU J78 on SIB C and into J78 on the IOU header panel. When connecting cables, observe connector polarization by aligning cable polarization keys with connector polarization notches.

Connector maps for all four SIBs are shown in figures 4-33 through 4-36 and are displayed on the hardware. All maps are shown from connector plug-in side, with the front of the CPU marked. The connector maps show the positions for three of the four different SIB cables. The fourth cable, the SIB to CM cable, is a 50-position cable routed between the CM control module which is located in the back of the CM and the outer panel of SIB A on the CP-0 cage. Source-destination labels for SIB to CM cables are displayed directly on the hardware.

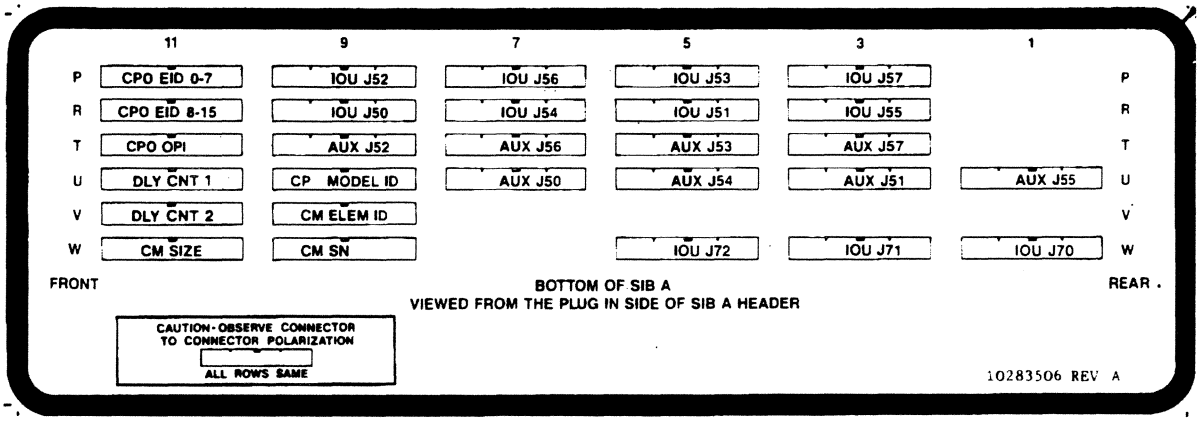

Figure 4-33. SIB A Connector Map

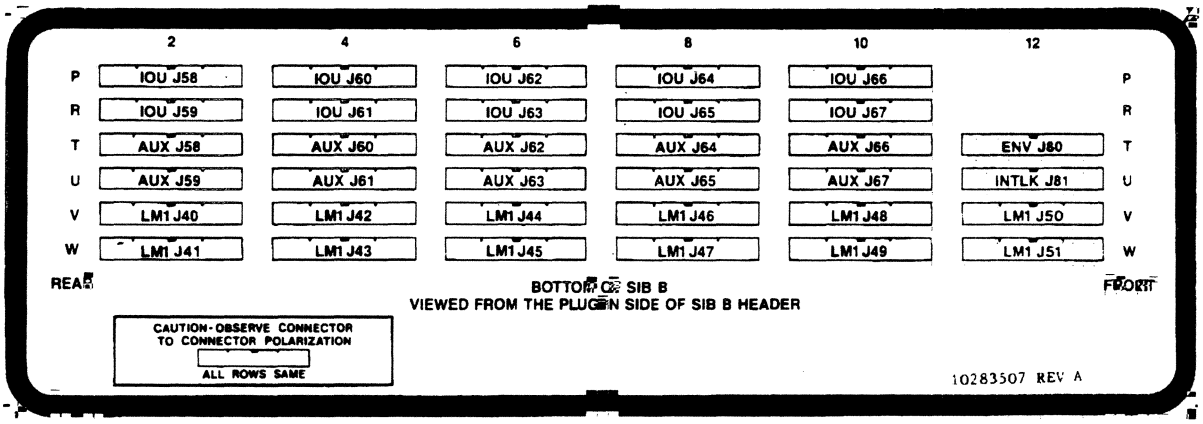

Figure 4-34. SIB B Connector Map

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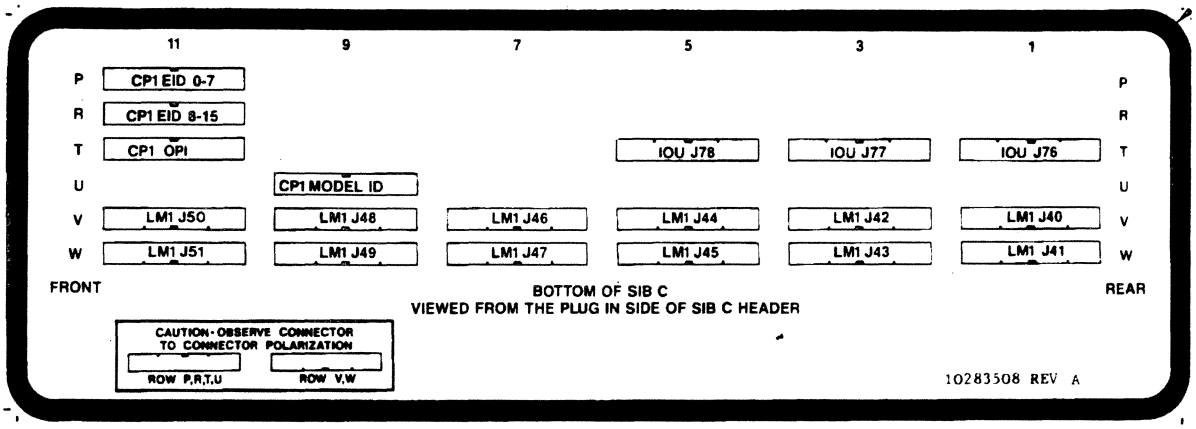

Figure 4-35. SIB C Connector Map

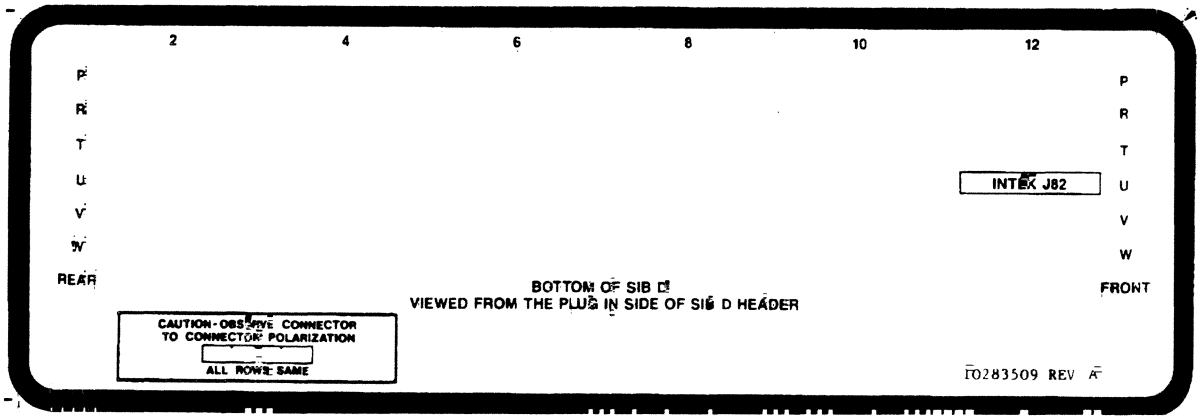

Figure 4-36. SIB D Connector Map

The CYBER 960 and the CYBER 962 have different types of input/output units (IOUs). The CYBER 960 system utilizes an IOU which operates in the dual state (NOS and/or NOS/VE). The CYBER 962 system utilizes an IOU for NOS/VE only. Due to the difference in IOUs, the SIB to IOU cables differ in part number, but do not differ in source or destination connector location. The cables used for each particular system are shown in tables 4-2 and 4-3.

Table 4-1. CYBER 960 SIB Cables

Source	Destination	Quantity	Part Number
SIB[1] J2,4,...24	CM J2,4,...24	12	22137205
SIB A, C J70-J72, J76-J78[2]	IOU J70-J72, J76-J78	6	22137204
SIB A IOU J50-J57	IOU J50-J57	8	10269102
SIB B IOU J60-J67	IOU J60-J67	8	10269103
SIB B IOU J58-J59	IOU J58-J59	2	10269104
SIB B[2] LM1 J40-J51	SIB C LM1 J40-J51	12	22137206
SIB B, D[3] J80-J82	Power Unit H6	3	10283756

Notes:

1. Located on rear outside of SIB A (CP-0).

2. Used only when CP-1 is present.

3. J82 used only when CP-1 is present.

Table 4-2. CYBER 962 SIB Cables

Source	Destination	Quantity	Part Number
SIB[1] J2,4,...24	CM J2,4,...24	12	22137205
SIB A, C IOU J70-J72, IOU J76-J78[2]	IOU J70-J72, J76-J78	6	22137204
SIB A, B IOU J50-J67	IOU J50-J67	18	22137204
SIB B[2] LM1 J40-J51	SIB C LM1 J40-J51	12	22137206
SIB B, D[3] J80-J82	Power Unit H6	3	10283756

Notes:

1. Located on rear outside of SIB A (CP-0).

2. Used only when CP-1 is present.

3. J82 used only when CP-1 is present.

SIB to CM Cable Removal and Replacement

Use this procedure to remove and replace any of the SIB cables connecting CP-0 to the CM control module.

Tools/parts required

- Wrist strap, antistatic

⚠CAUTION

Use extreme care when removing and replacing cables to prevent damage to cable pins and connectors.

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Locate SIB cable to be removed, and open connector latches to release cable from SIB (figure 4-37).

___ 4. Route cable to CM control module, open connector latches to release cable and remove.

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Route cable between CM control module and SIB. Connect both ends, aligning cable polarization keys with connector polarization notches.

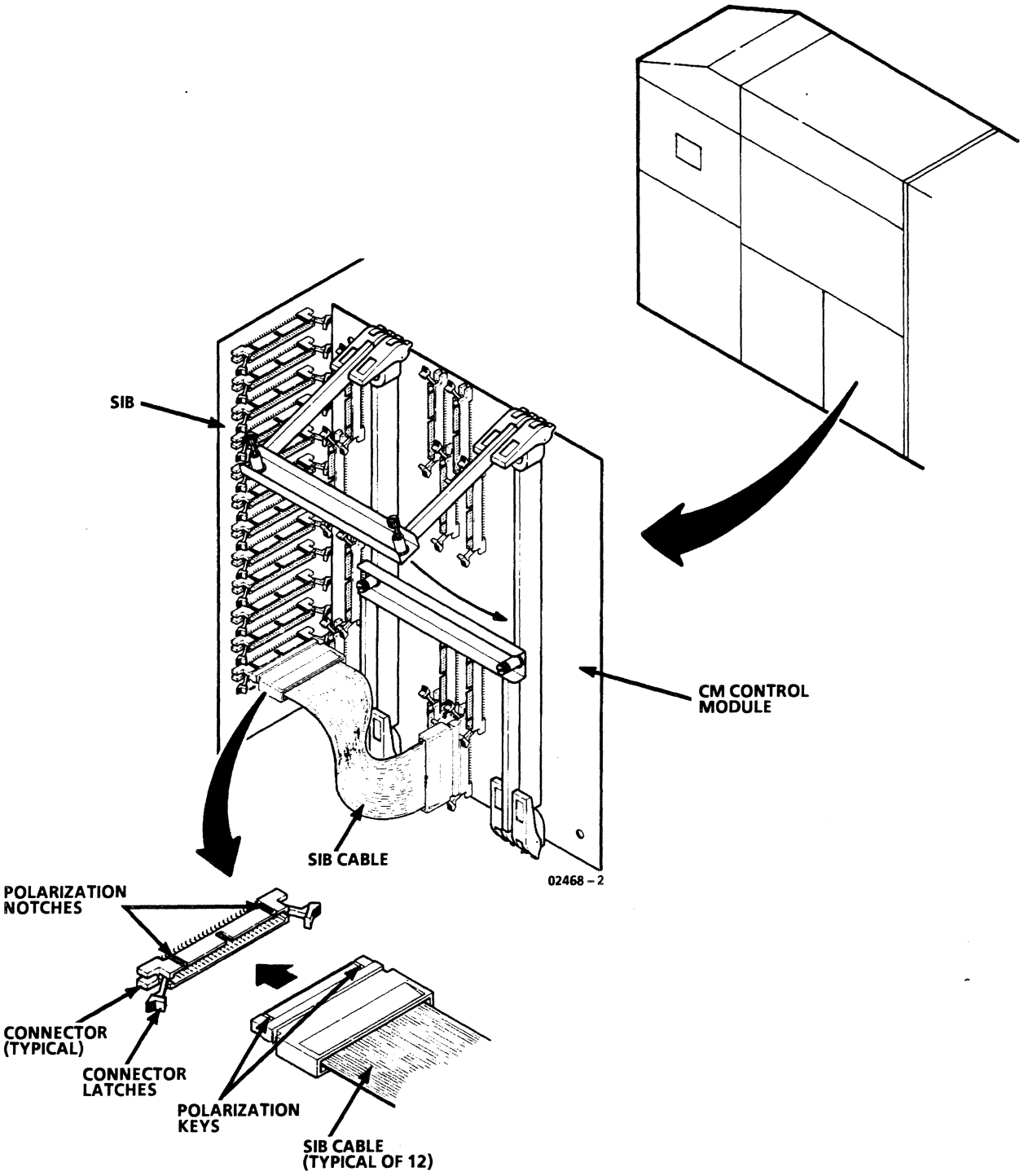

Figure 4-37. SIB to CM Cables

SIB to IOU Cable Removal and Replacement

Use this procedure to remove and replace any of the cables connecting the SIB to the IOU.

Tools/parts required

- Wrist strap, antistatic
- Bag, antistatic
- Screwdriver set, Torx (short handle)

⚠CAUTION

Use extreme care when removing and replacing cables to prevent damage to cable pins and connectors.

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Label (if necessary) and remove J1 and J3 from front of CP regulator pak in logic cage to which faulty SIB cable is connected. Do not remove J2 (figure 4-38).

___ 4. Remove regulator pak retaining screw.

___ 5. Slide out regulator pak and place in antistatic bag.

___ 6. Remove screws from channel guide and remove channel guide.

___ 7. Using connector maps, locate SIB cable to be removed, and open connector latches to release cable from SIB.

___ 8. Remove nuts from clamp holding cable to chassis.

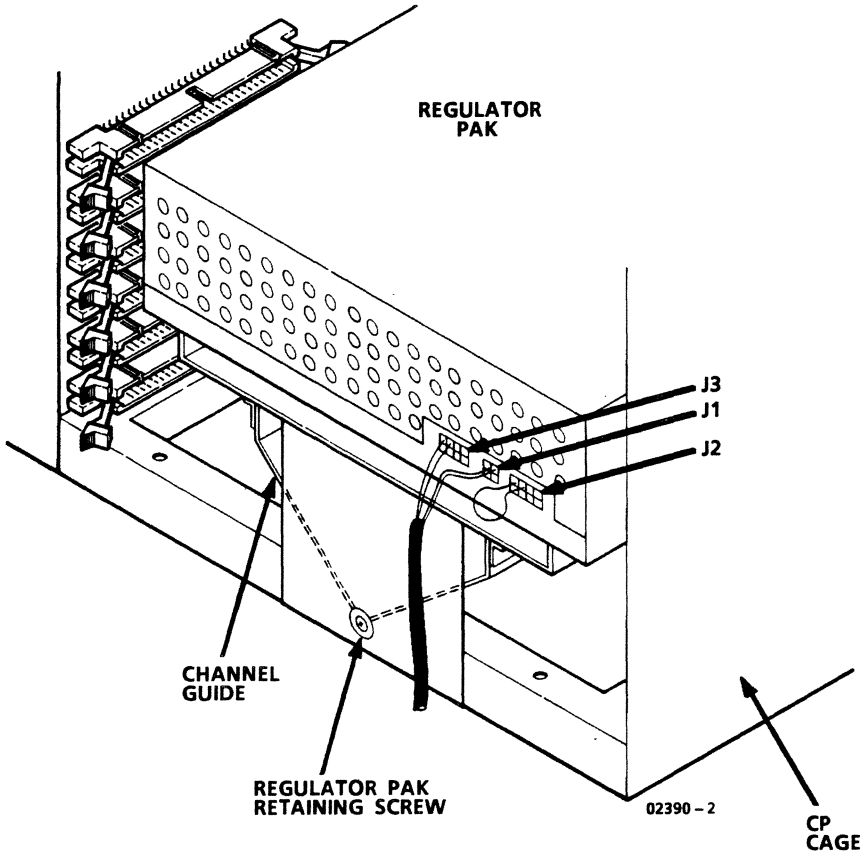

Figure 4-38. CP Regulator Pak

___ 9. Route SIB cable to IOU header panel, open connector latches to release cable, and remove (figure 4-39).

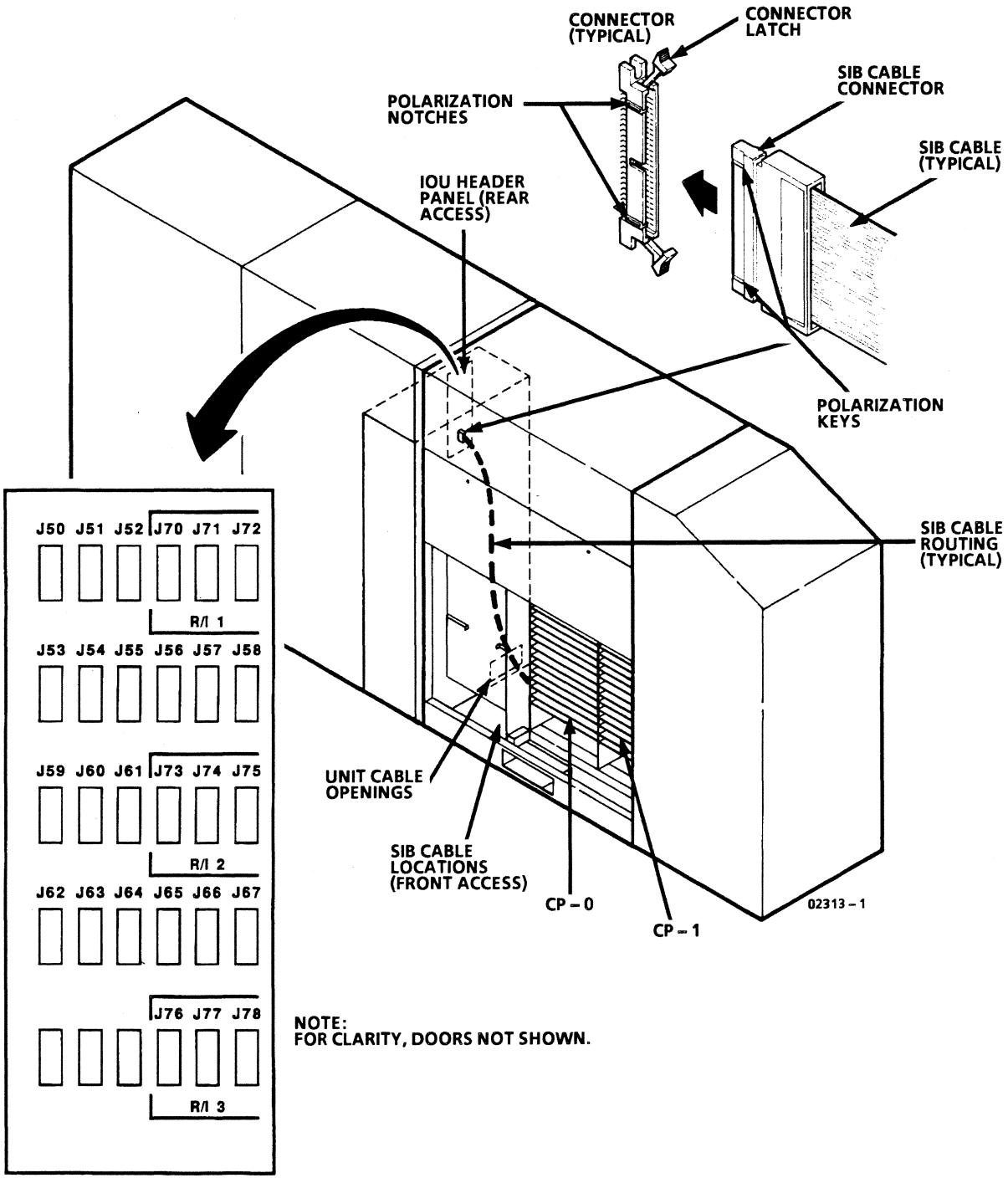

Figure 4-39. SIB Cables from CPU to IOU

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Label cable (if necessary) and route between SIB and IOU header panel. Connect both ends, aligning cable polarization keys with connector polarization notches.

___ 3. Replace clamp holding cable to chassis and bolt into place.

___ 4. Place channel guide in bottom of CP cage and replace screws (figure 4-40).

___ 5. Remove regulator pak from antistatic bag and slide into CP cage until resistance is felt, then push through resistance until regulator pak seats.

___ 6. Replace regulator pak retaining screw.

___ 7. Replace J1 and J3.

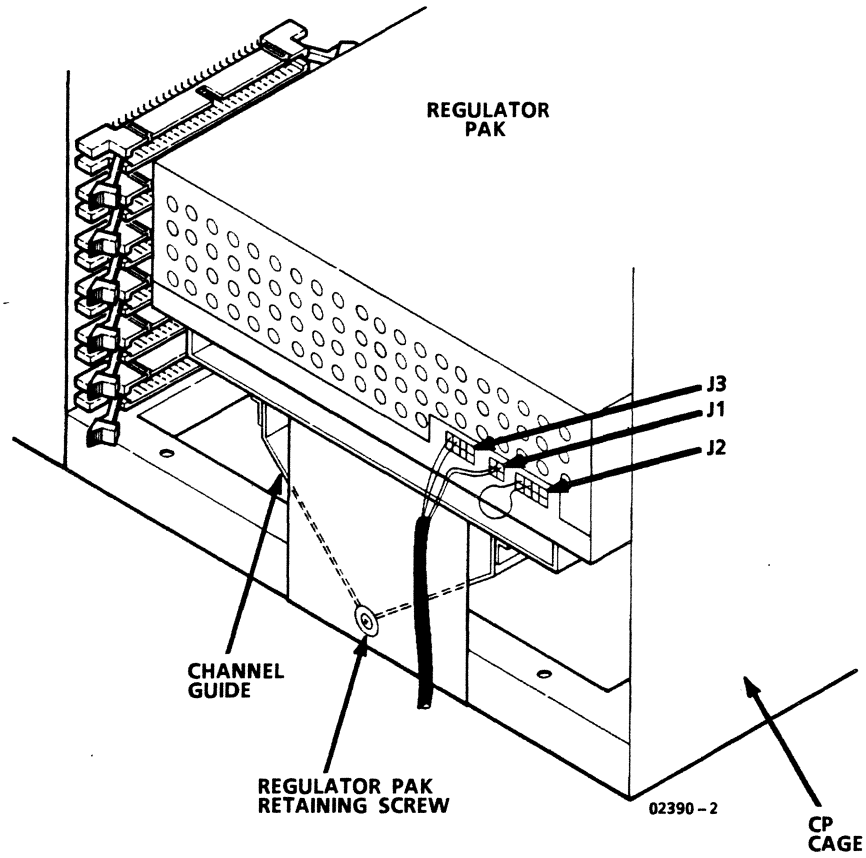

Figure 4-40. CP Regulator Pak

SIB to SIB Cable Removal and Replacement

Use this procedure to remove and replace any of the cables connecting the SIBs of CP-0 and CP-1.

Tools/parts required

- Wrist strap, antistatic
- Bag, antistatic
- Screwdriver set, Torx (short handle)

⚠CAUTION

Use extreme care when removing and replacing cables to prevent damage to cable pins and connectors.

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on main control panel of power unit to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Label (if necessary) and remove J1 and J3 from front of CP regulator pak. Do not remove J2 (figure 4-41).

___ 4. Remove regulator pak retaining screw.

___ 5. Slide out regulator pak and place in antistatic bag.

___ 6. Remove screws from channel guide and remove channel guide.

___ 7. Repeat steps 3 through 6 for other CP regulator pak.

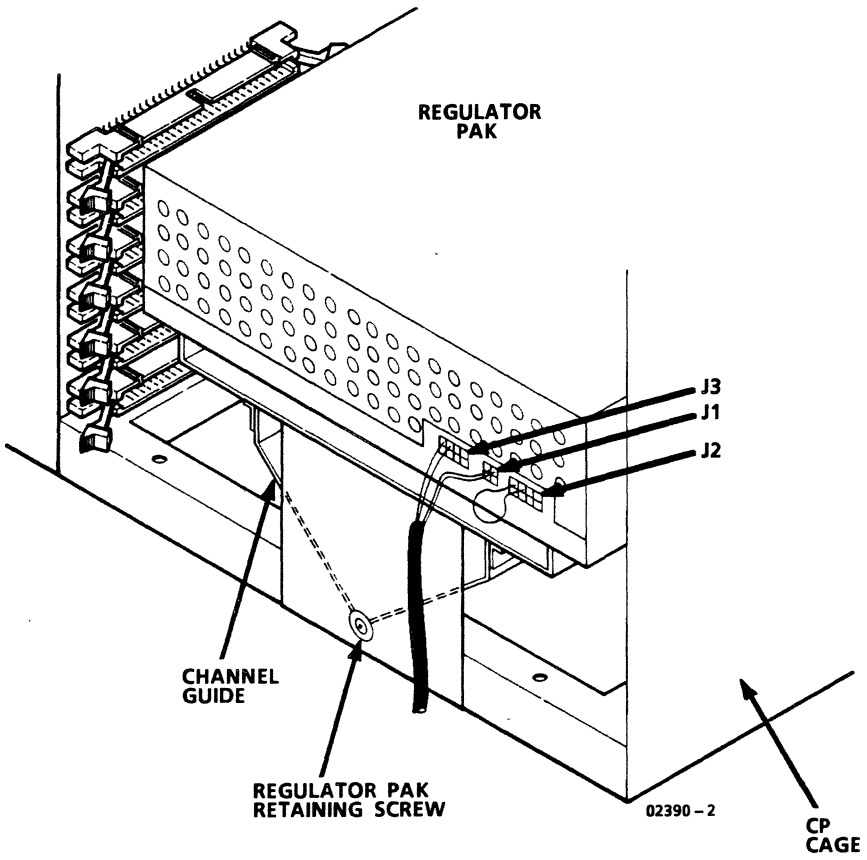

Figure 4-41. CP Regulator Pak

___ 8. Using connector maps, locate SIB cable to be removed, and open connector latches to release cable from SIB. (figure 4-42)

___ 9. Route cable to adjacent SIB, open connector latches to release cable, and remove.

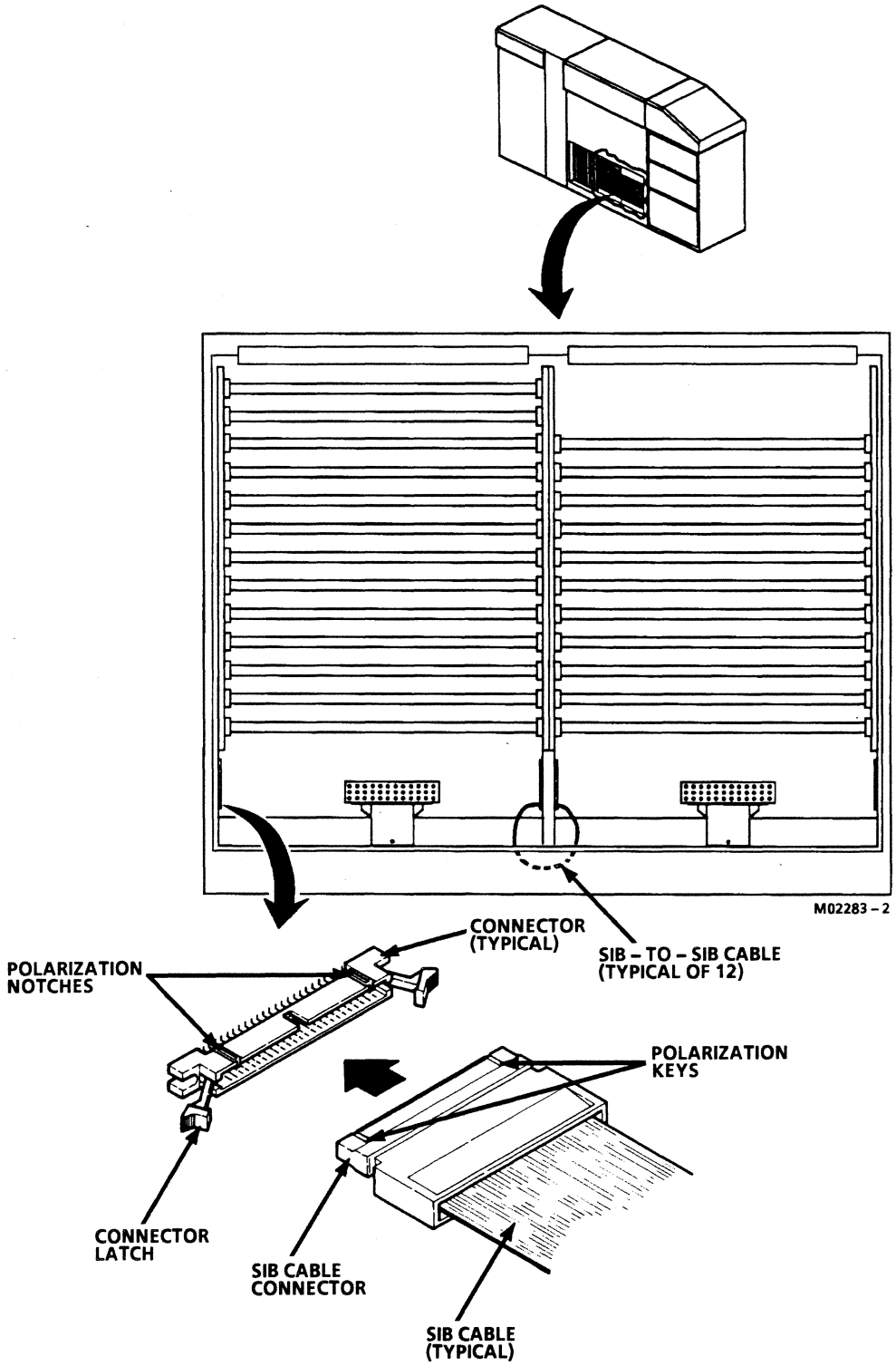

Figure 4-42. SIB to SIB Cables

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Route cable between SIBs. Connect both ends, aligning cable polarization keys with connector polarization notches.

___ 3. Place channel guide in bottom of CP cage and replace Torx screws (figure 4-43).

___ 4. Remove regulator pak from antistatic bag and slide on channel guide into CP cage until resistance is felt, then push through resistance until regulator pak seats.

___ 5. Replace regulator pak retaining screw.

___ 6. Replace J1 and J3.

___ 7. Repeat steps 2 through 5 for other CP regulator pak.

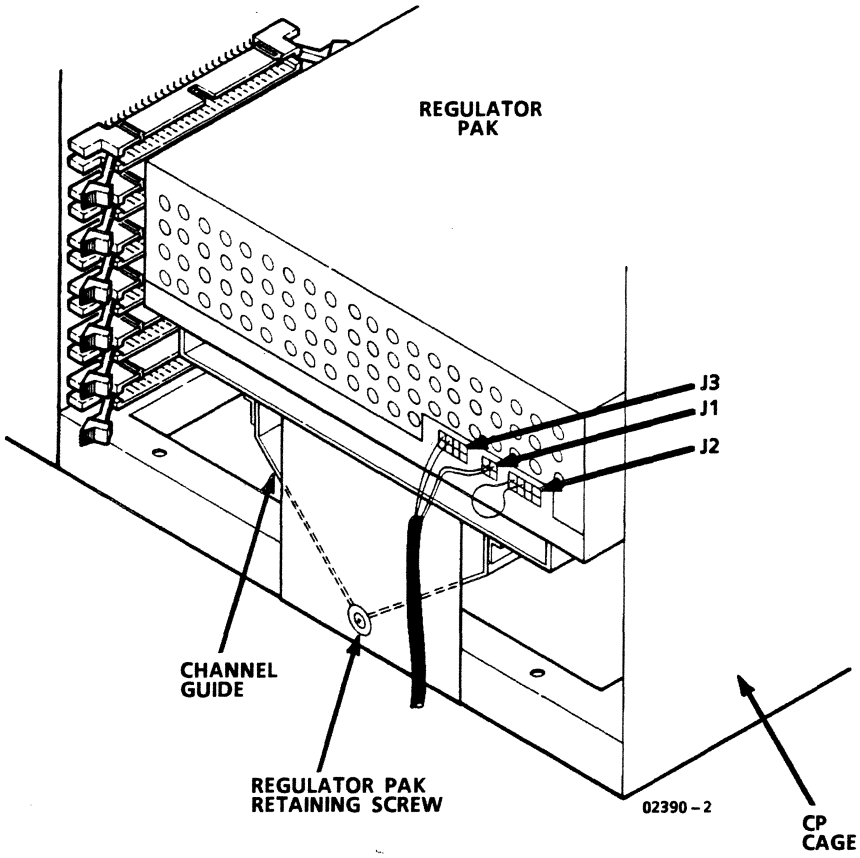

Figure 4-43. CP Regulator Pak

SIB to Power Unit Cable Removal and Replacement

Use this procedure to remove and replace the cable connecting the SIB to the power unit.

Tools/parts required

- Wrist strap, antistatic
- Screwdriver, Phillips
- Screwdriver, slotted (short handle)
- Nutdriver set (short handle)
- Insertion/extraction tool

⚠CAUTION

Use extreme care when removing and replacing cables to prevent damage to cable pins and connectors.

Removal

___ 1. Remove power from CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch to DISABLE and removing 50/60- and 400-Hz power at the site source.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Locate SIB cable to be removed, and open connector latches to release cable from SIB (figure 4-44).

___ 4. Route cable to power unit.

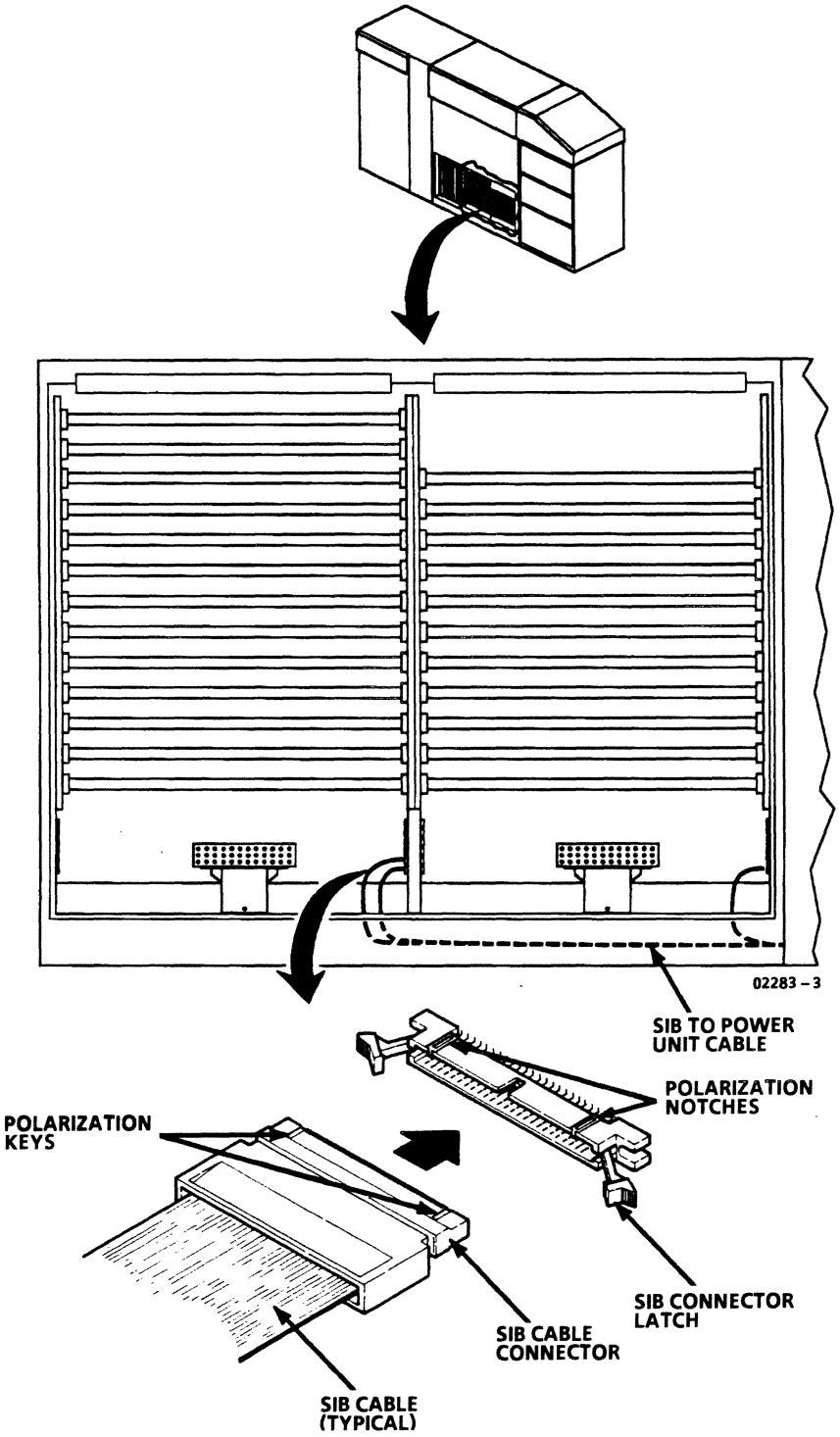

Figure 4-44. SIB to Power Unit Cable

___ 5. Remove front lower access panel from power unit.

___ 6. On power unit side of CPU connector header, loosen screw fasteners and remove connector plug P6 from J6 (figure 4-45).

___ 7. Remove retaining nuts from H6 and remove H6.

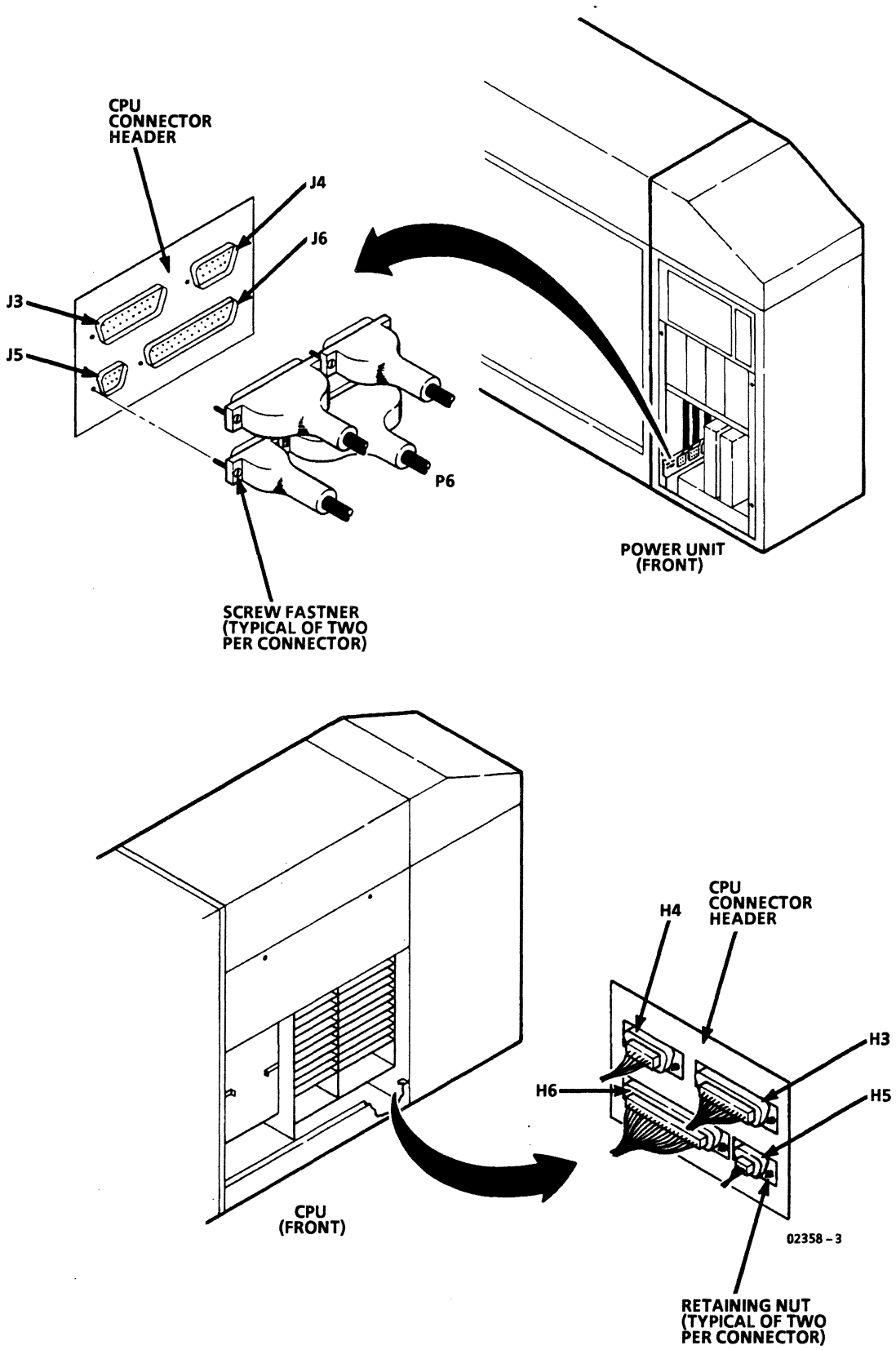

Figure 4-45. CPU/Power Unit Connector Header

___ 8. Using extraction tool, remove from H6 only those wires that terminate the SIB cable.

⚠CAUTION

When using extraction tool, excessive force or bending or twisting on the wires may cause them to break.

To use extraction tool:

___ a. Insert extraction tool (red end) into hole around wire until it "snaps" into position (figure 4-46).

___ b. Tighten wire and hold against gripper on extraction tool.

___ c. Rotate while pulling back on wire and extraction tool until socket comes out.

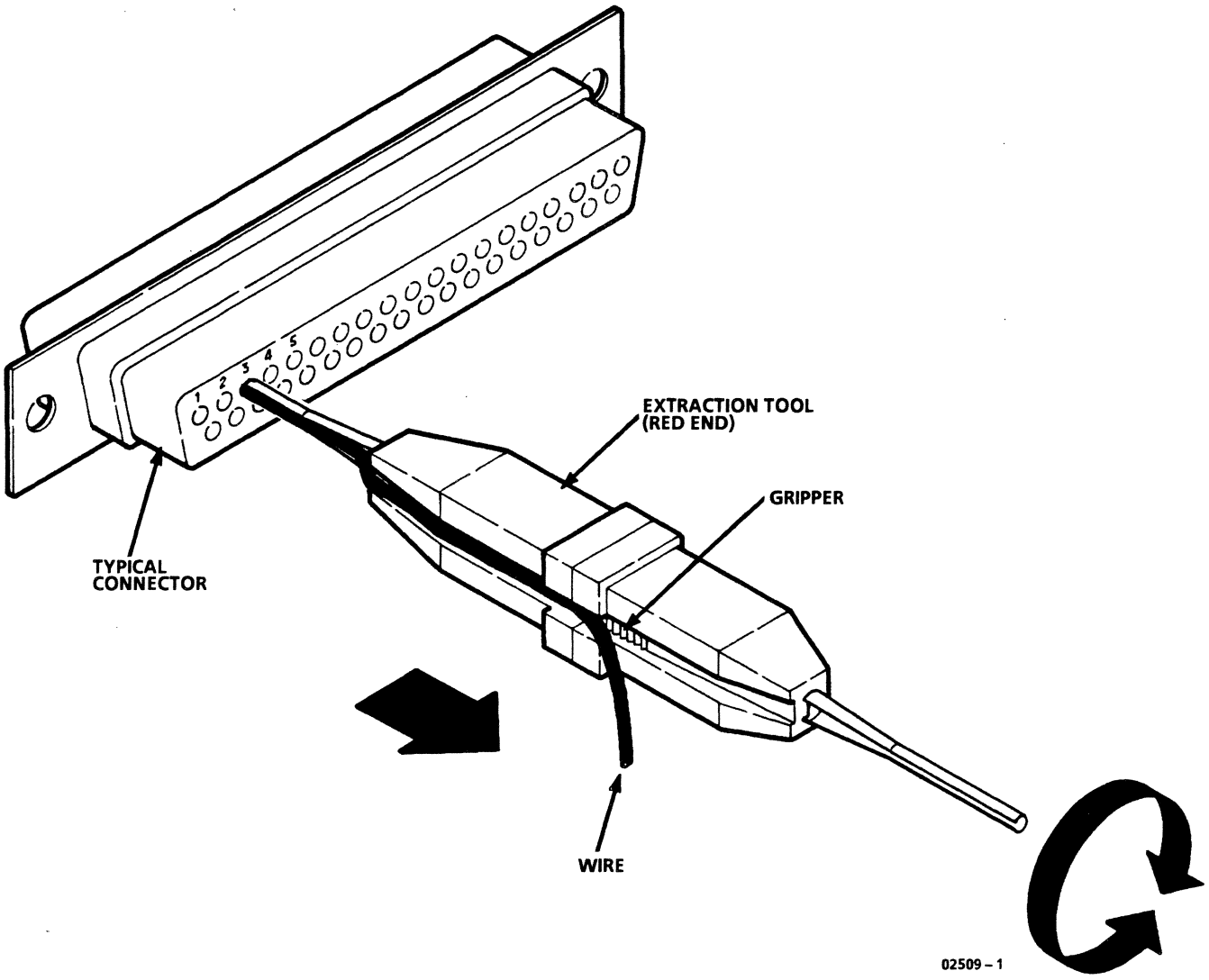

Figure 4-46. Socket Extraction

Replacement

⚠CAUTION

When replacing wires, be sure to match labeled wire with corresponding numbered hole.

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Use insertion tool (white end) to insert wires from new SIB cable into H6.
To use insertion tool:

___ a. Push slot of insertion tool over crimped portion of wire (figure 4-47).

___ b. Holding end of insertion tool against base of socket, push socket into hole until it will advance no further.

___ 3. Replace H6 and tighten retaining nuts.

___ 4. Reconnect P6 and tighten screw fasteners.

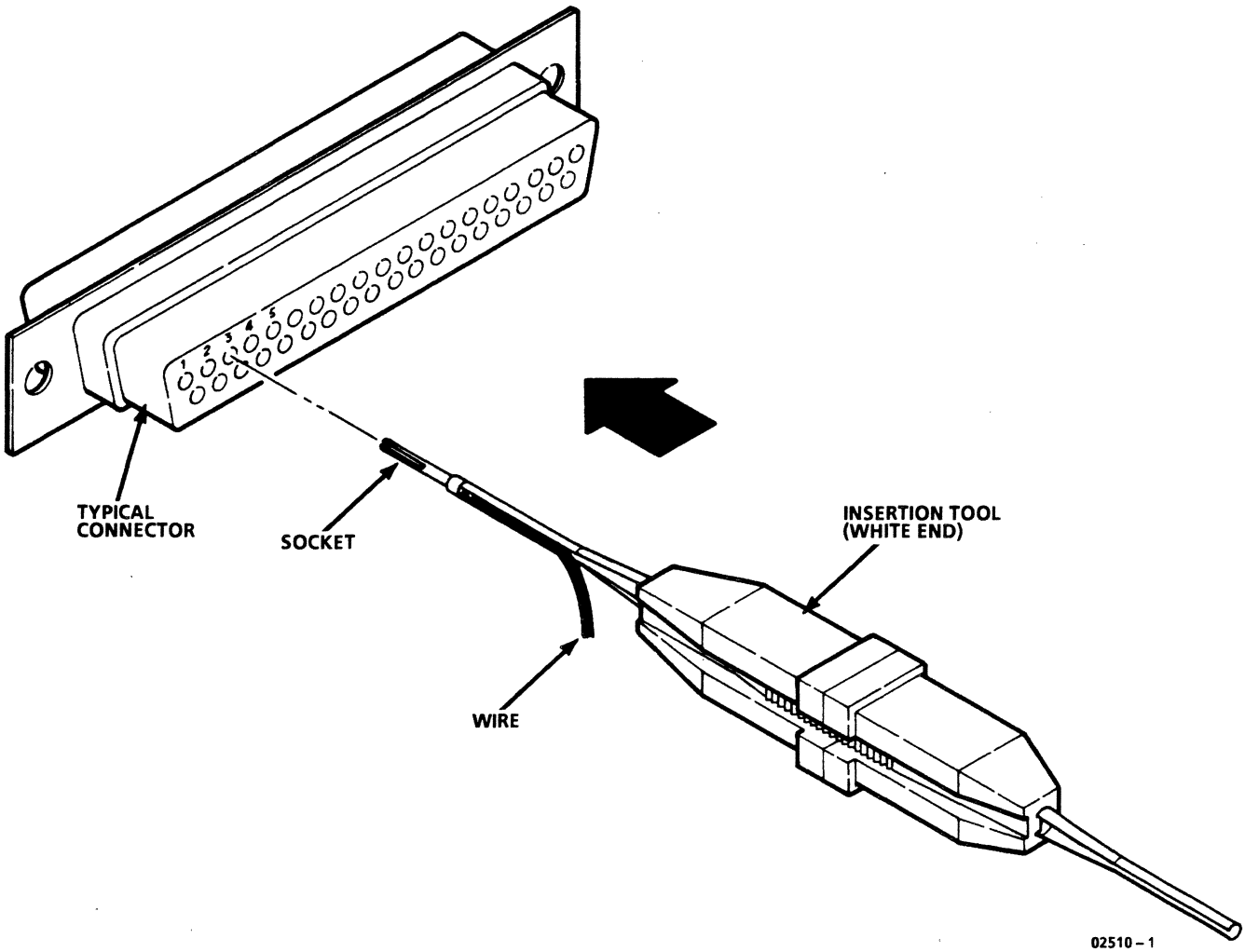

Figure 4-47. Socket Insertion

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___ 5. Route cable to SIB and connect, aligning cable polarization keys with connector polarization notches (figure 4-48).

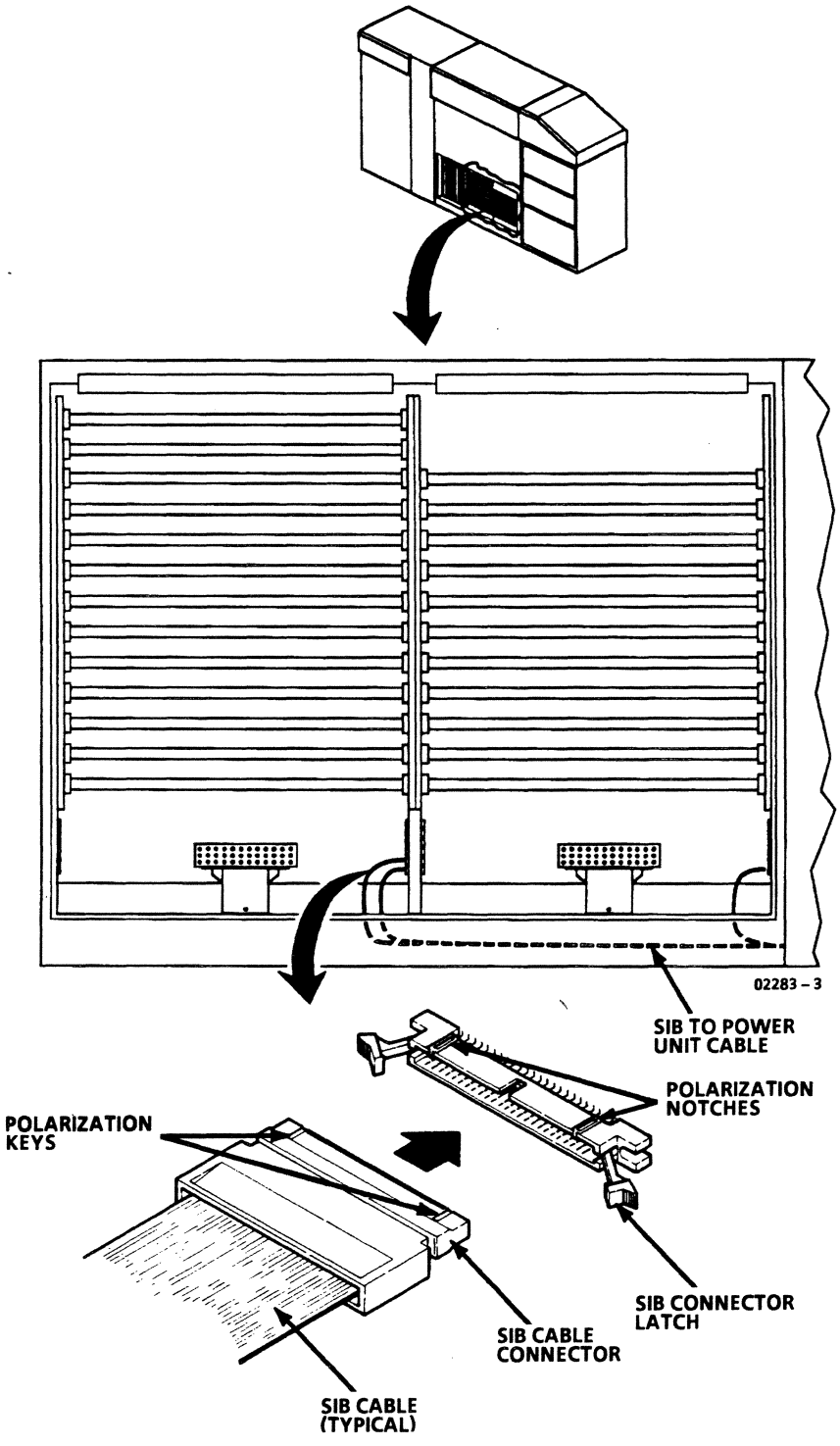


Figure 4-48. SIB to Power Unit Cable

Temperature Sensor Removal and Replacement

Use the following procedures to remove and replace any of the CPU temperature sensors shown in figures 4-49 and 4-50.

NOTE

A faulty reverse airflow sensor is replaced by replacing the CM voltage regulator module on which it is located.

Tools/parts required

- Wrist strap, antistatic
- Socket set, 1/4-in drive
- Screwdriver, Phillips
- Wrench, Allen, 5/16 in
- Wrench, open end
- Wrench, torque, 1000 lbf•in

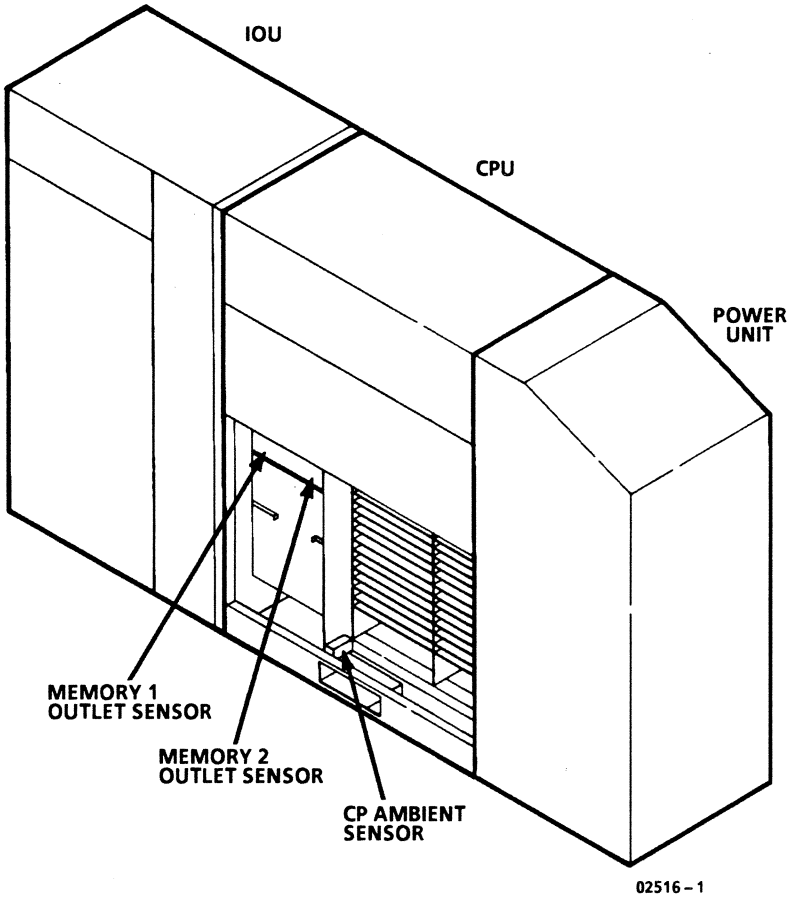


Figure 4-49. CPU Front Sensor Locations

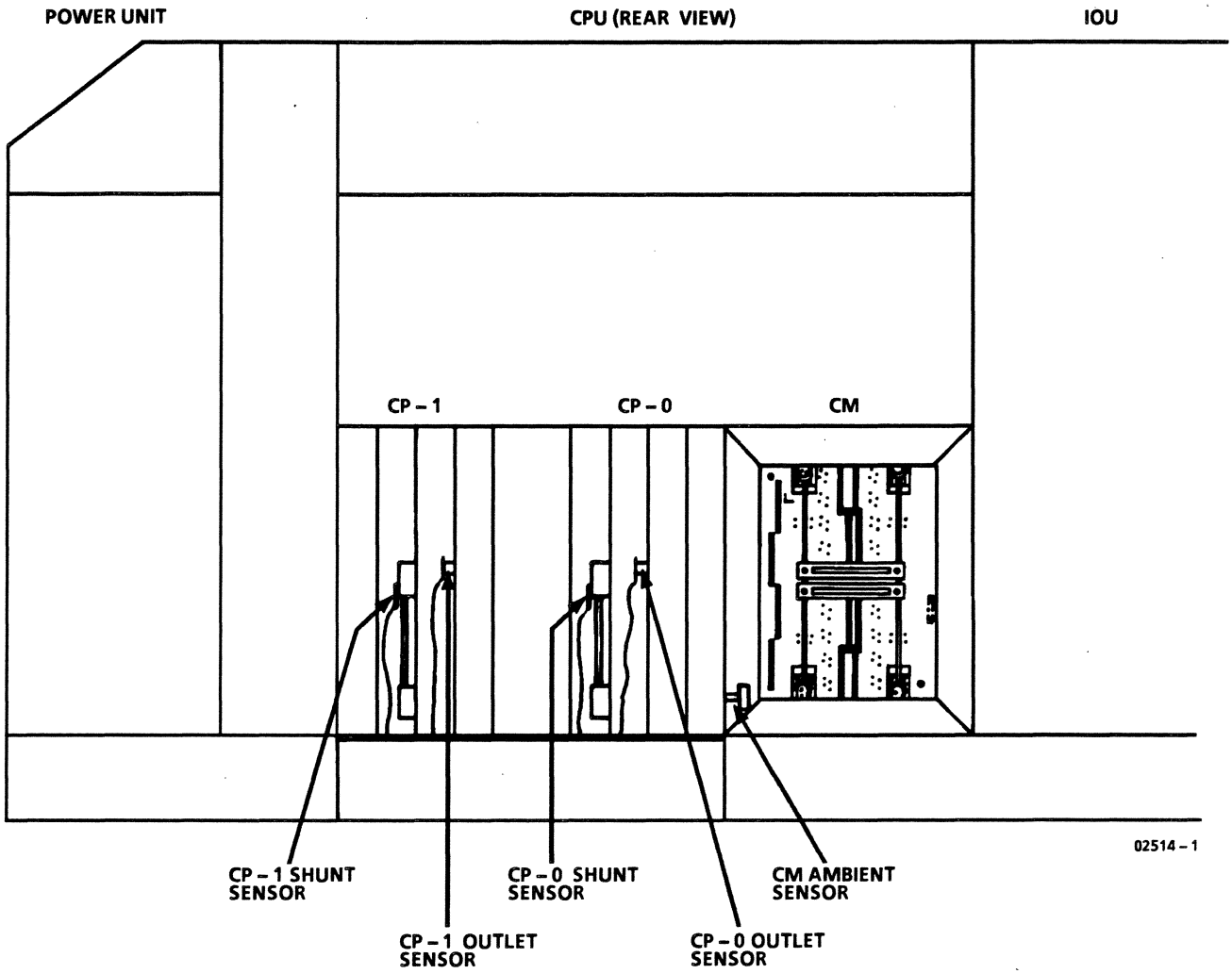


Figure 4-50. CPU Rear Sensor Locations

Memory Outlet Sensor Removal and Replacement

Use this procedure to remove and replace the memory outlet sensor.

Removal

___ 1. Remove power from the CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on the main control panel to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Remove access panel from CM (figure 4-51).

___ 4. Lift mounting bracket from circuit board guide.

___ 5. Disconnect cable connector from sensor card.

___ 6. Remove bolts holding sensor card to mounting bracket and remove sensor card.

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Attach sensor card to mounting bracket.

___ 3. Reconnect cable connector.

___ 4. Clip mounting bracket to circuit board guide.

___ 5. Replace access panel.

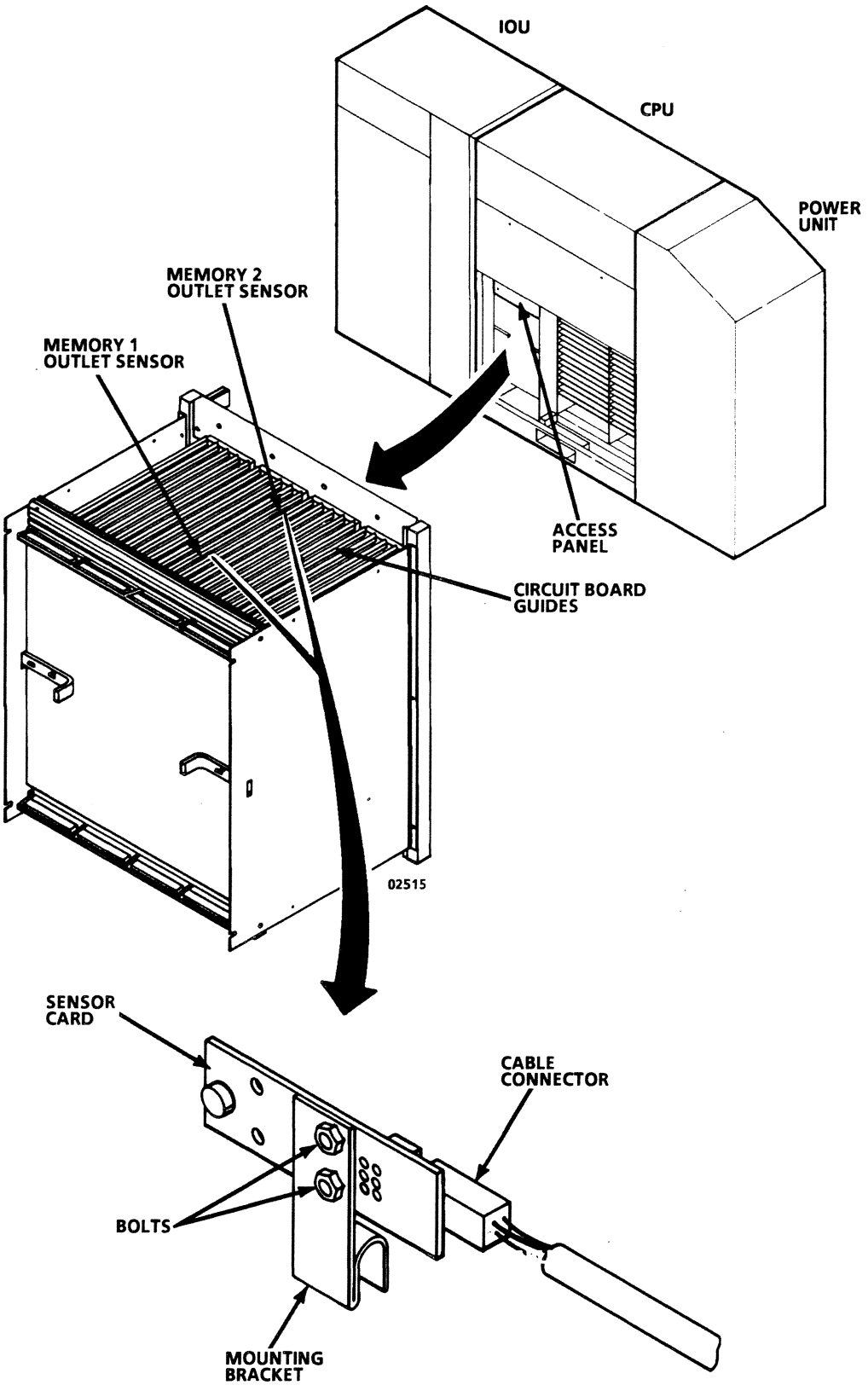


Figure 4-51. Memory Outlet Sensors

Ambient Sensor Removal and Replacement

Use this procedure to remove and replace either the CP or CM ambient sensor.

NOTE

Location of CM ambient sensor is shown in figure 4-50. Mounting bracket and removal/replacement procedure is the same as for the CP ambient sensor, shown in figure 4-52.

Removal

___ 1. Remove power from the CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on the main control panel to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Remove bolts holding mounting bracket to chassis (figure 4-52).

___ 4. Disconnect cable connector from sensor card.

___ 5. Remove bolts holding sensor card to mounting bracket and remove sensor card.

Replacement

___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Attach sensor card to mounting bracket.

___ 3. Reconnect cable connector.

___ 4. Reattach mounting bracket to chassis.

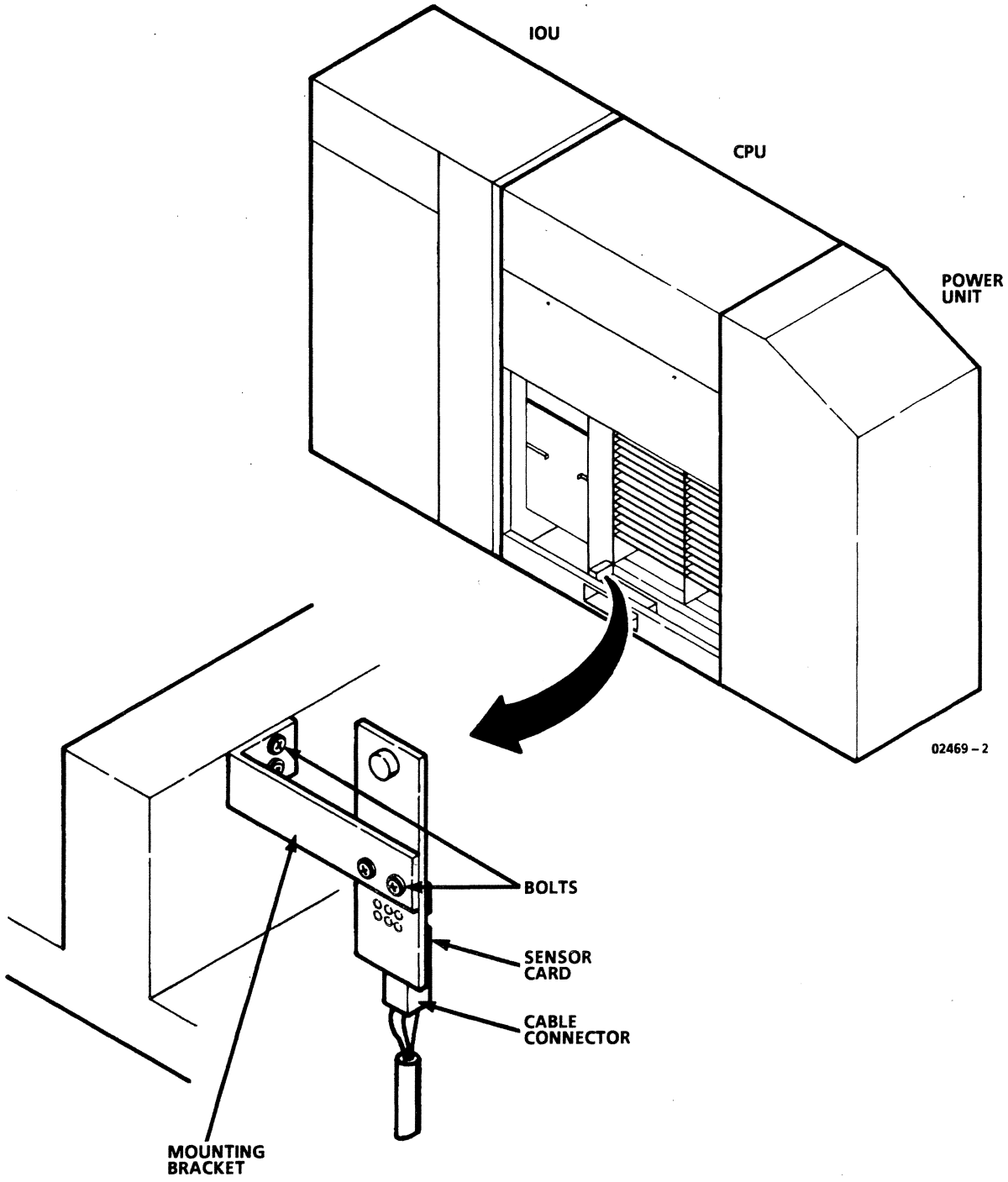


Figure 4-52. Ambient Sensor

CP Outlet Sensor Removal and Replacement

Use this procedure to remove and replace the CP outlet sensor.

Removal

___ 1. Remove power from the CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on the main control panel to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Loosen quarter-turn pop screws on rear access panel of CP and remove access panel.

NOTE

Carefully note mounting bracket to power bus bar orientation before removing mounting bracket.

___ 4. Remove bolts holding mounting bracket to power bus bar and remove mounting bracket (figure 4-53).

___ 5. Disconnect cable connector from sensor card.

___ 6. Remove bolts holding sensor card to mounting bracket and remove sensor card.

Replacement

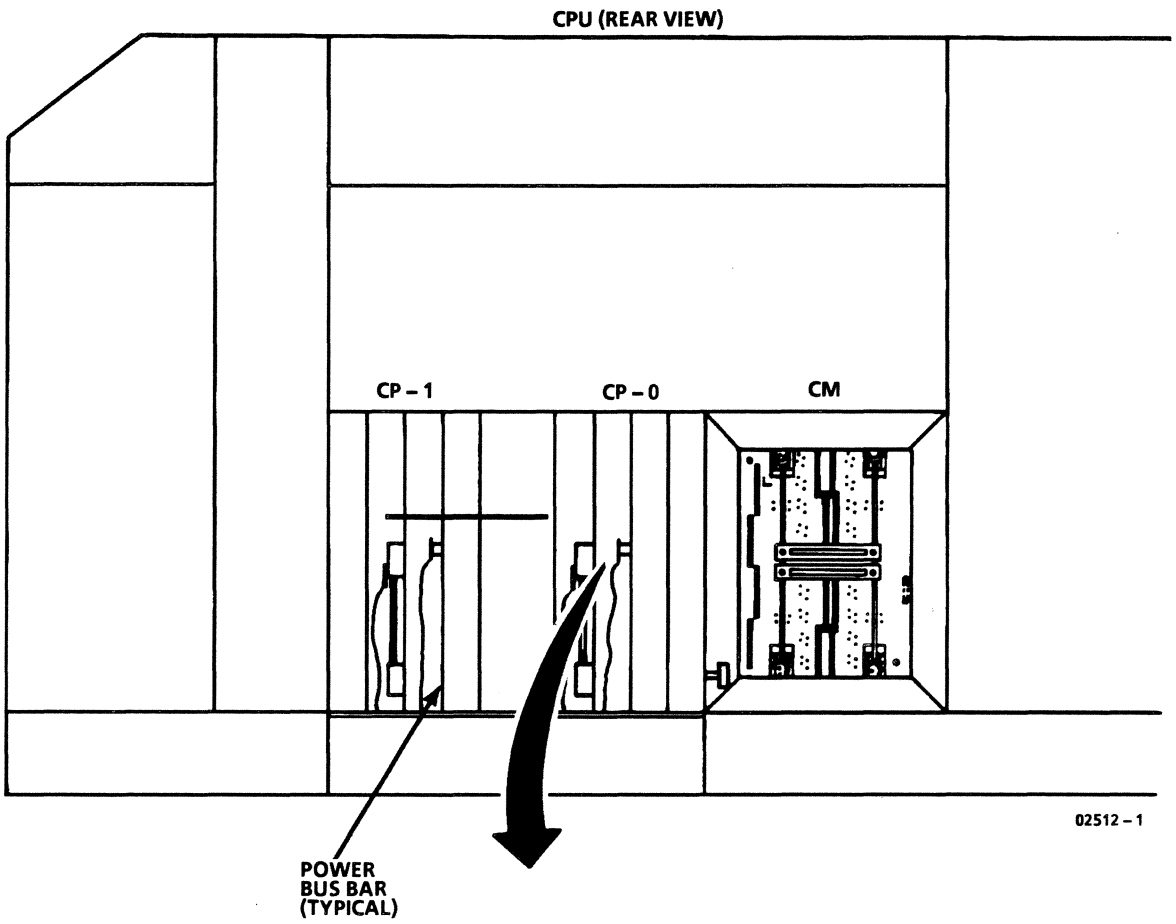
___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Attach sensor card to mounting bracket.

___ 3. Reconnect cable connector.

___ 4. Reattach mounting bracket to power bus bar and use torque wrench to tighten bolts to 7.3 N•m (65 lbf•in).

___ 5. Replace rear access panel.



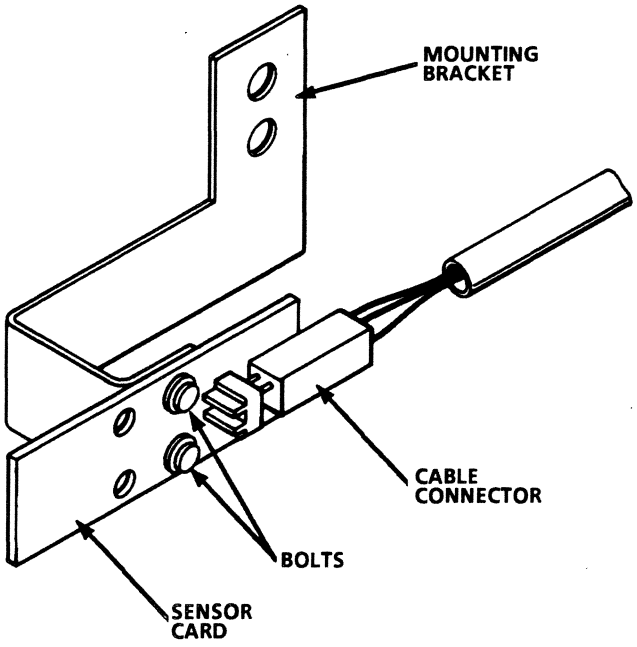


Figure 4-53. CP Outlet Sensors

CP Shunt Sensor Removal and Replacement

Use this procedure to remove and replace the CP shunt sensor.

Removal

___ 1. Remove power from the CPU by setting CPU/MEMORY NORMAL/DISABLE toggle switch located on the main control panel to DISABLE.

___ 2. Attach antistatic wrist strap to wrist and frame ground.

___ 3. Loosen quarter-turn pop screws on rear access panel of CP and remove access panel.

NOTE

Carefully note mounting bracket to power bus bar orientation before removing mounting bracket.

___ 4. Remove bolts holding mounting bracket to power bus bar (figure 4-54).

___ 5. Disconnect cable connector from sensor card.

___ 6. Remove bolts holding sensor card to mounting bracket and remove sensor card.

Replacement

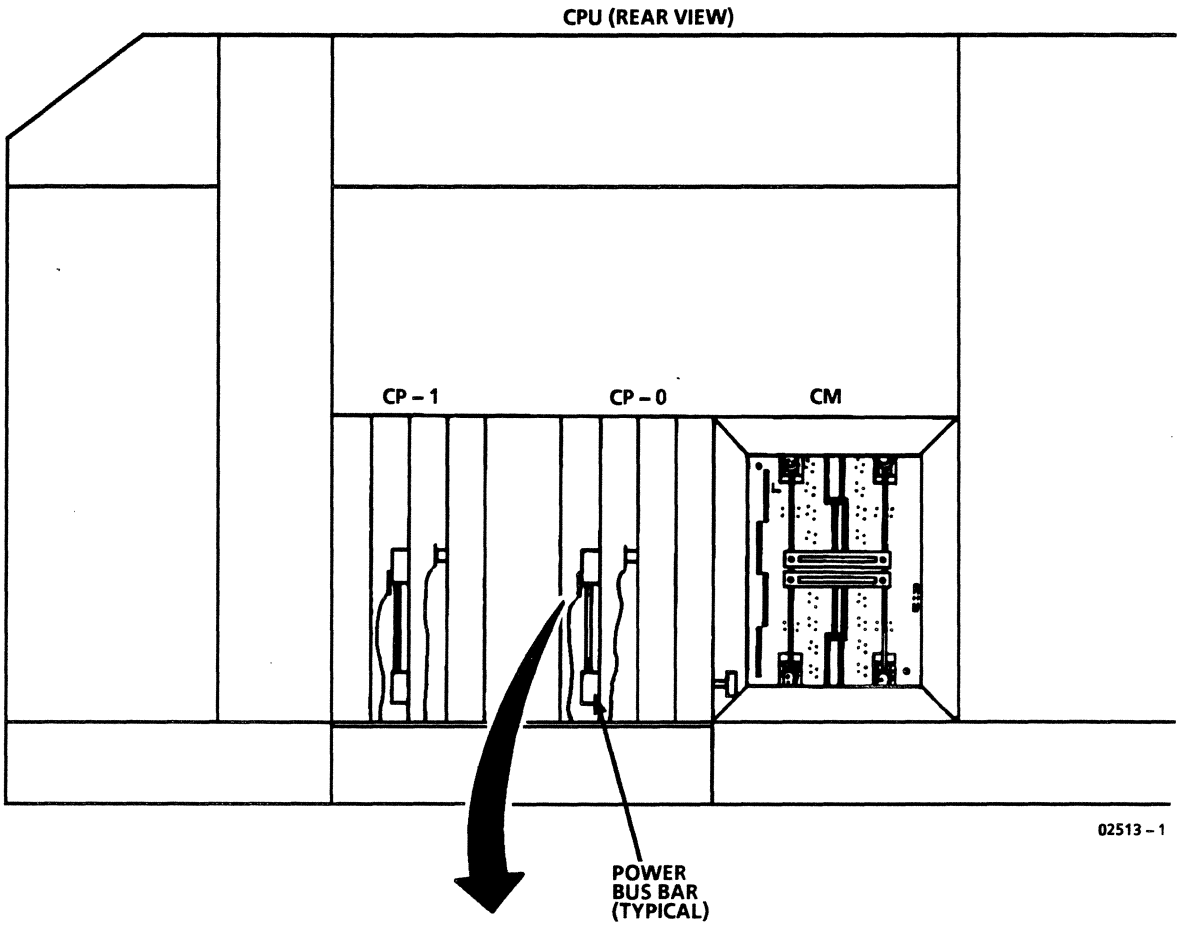
___ 1. Attach antistatic wrist strap to wrist and frame ground.

___ 2. Attach sensor card to mounting bracket.

___ 3. Reconnect cable connector.

___ 4. Reattach mounting bracket to power bus bar and use torque wrench to tighten bolts to 7.3 N•m (65 lbf•in).

___ 5. Replace rear access panel.



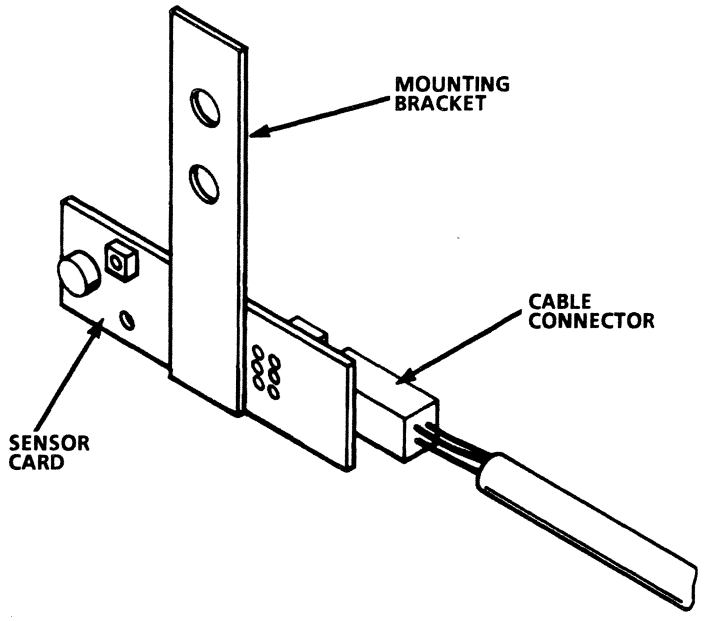


Figure 4-54. CP Shunt Sensors

Glossary A

Glossary A

A

A

See Ampere.

AC

Address control.

ALN

Arithmetic logic network.

Ampere (A)

A unit of electrical current or rate of flow of electrons. One volt across 1 ohm of resistance causes a current flow of 1 ampere.

B

BDP

Business data processor.

C

CDC

Control Data Corporation.

CE

Customer engineer.

Central Memory (CM)

The main memory of the CYBER 960/962 within the central processing unit cabinet. CM stores between 64 and 256 megabytes of data on 4 to 16 memory modules. CM hardware includes memory modules, a dedicated logic cage, a memory interface module, and voltage regulator modules.

Central Memory Control (CMC)

The logic element in the CPU that controls the movement of data between central memory (CMCA and CMCB) and the central processor. The CMC circuits reside on two logic modules located in the CP-0 logic cage, but accomplish memory control for both CP-0 and CP-1.

Central Processing Unit (CPU)

The main processing cabinet in the CYBER 960 Series mainframe, which includes the central processor (CP-0 and CP-1), central memory control, and central memory. The CPU cabinet has up to two central processors and between 64 and 256 megabytes of resident memory.

Central Processor (CP)

The functional processing logic within the CYBER 960/962 CPU. The first (or standard) central processor is referred to as CP-0. If a second central processor is provided with a system, it is referred to as CP-1. Each central processor resides in a separate logic cage and consists of eleven logic modules.

CHS

CYBER hardware support.

CIO

See Concurrent Input/Output.

CM

See Central Memory.

CMC

See Central Memory Control.

CMCA

See Central Memory Control.

CMCB

See Central Memory Control.

Concurrent Input/Output (CIO)

An input/output unit architecture that functions with the NOS/VE operating system.

Corrective maintenance

1. (ISO) Maintenance performed specifically to overcome existing faults. 2. Contrast with Preventive Maintenance.

CP

See Central Processor. See also Central Processing Unit.

CP-0

See Central Processor. See also Central Processing Unit.

CP-1

See Central Processor. See also Central Processing Unit.

CPU

See Central Processing Unit.

CST/MAC

Control store/maintenance access control.

CYBER 960 Series (960/962) Computer Systems

Includes CYBER 960 and CYBER 962 computer systems. The CYBER 960 Series is Control Data's state-of-the-art middle- to high-range system, flanked by the 930 departmental computer on the low end and the 990 computer on the high end of the scalar performance spectrum. A full 960 system includes the mainframe (CPU, IOU, and power unit), M-G set, system console, operating software, and a complement of peripherals.

D

Dual CP

See Central Processor.

E

ECL

Emitter-coupled logic.

ESD

Electrostatic discharge.

F

FCC

See Federal Communication Compliance.

FCO

Field change order.

Federal Communication Compliance (FCC)

This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device (insert peripheral computing device if appropriate) pursuant to Subpart J of Part 15 of the FCC Rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Field-Replaceable Unit (FRU)

Equipment parts that are replaceable at the customer site are referred to as FRUs. Equipment manuals generally recommend a list of FRUs that should be stocked on site for that equipment. FRUs are identified with 8-digit part numbers that can be ordered from Control Data's World Distribution Center (WDC). See also World Distribution Center.

Frequency converter

A motor generator mounted within its control cabinet.

FRU

See Field-Replaceable Unit.

FSC

Fault symptom code.

H

Hertz (Hz)

A measure of frequency or band width the same as cycles per second.

Horsepower (HP)

A unit of power equal to 746 watts.

HP

See Horsepower.

Hz

See Hertz.

I

IF/IC

Instruction fetch/instruction control.

Input/Output Unit (IOU)

IOU contains the peripheral processors and channels that enable operator interaction with, and peripherals access to, the central processing unit. The IOU has either NOS and NOS/VE capability (CYBER 960) or is NOS/VE only (CYBER 962). The IOU has the interface port for the system console.

IOU

See Input/Output Unit.

IOU Expansion

An add-on IOU product that physically attaches to the CYBER 960 IOU. The IOU expansion is a concurrent input/output (CIO) architecture and allows for addition of up to ten peripheral processors and ten channels. The IOU expansion is the first IOU option to be added to a CYBER 960 mainframe, increasing the number of IOU cabinets to two.

L

Large-Scale Integrated Circuit

A chip that contains around 100 to 1000 logical gates.

LDS

Literature Distribution Services

LM

See Local Memory.

LMA

See Local Memory.

LMB

See Local Memory.

Local Memory (LM)

The storage area with accompanying control that provides a high-speed interface between the central processor and central memory. LM is contained by two logic modules, LMA and LMB. See also Cache.

Logic Cage

Hardware structure in mainframe central processing unit, input/output unit, or power unit that houses logic as memory modules or power boards.

Logic Module

A printed-circuit board with microcircuit chips.

LSI

See Large-Scale Integrated Circuit.

M

MAF

Maintenance action form.

Mainframe

Includes the central processing unit, input/output unit, and power unit portions of the mainframe complex. The mainframe does not include the motor-generator set or the system console.

MD

Multiply/divide.

MG

See Motor-Generator Set.

Motor-Generator (MG) Interface Unit

The electrical box that interfaces with the motor-generator set. Also see Motor-Generator (MG) Set.

Motor-Generator (MG) Set

A motor generator and a separate motor-generator control cabinet that converts 3-phase site utility power to 3-phase, 400-Hz power suitable for the mainframe electrical requirements. Smaller MG sets may include the MG and its MG control functions within one cabinet and be referred to as a frequency converter.

N

Network Operating System (NOS)

An operating system for the host computer. It has network capabilities for time-sharing and transmission processing in addition to local and remote batch processing. NOS controls the computation of programs submitted through remote terminals and maintains normal batch processing operations for jobs submitted locally.

Network Operating System/Virtual Environment (NOS/VE)

An operating system for the host computer. It has network capabilities for time-sharing and transmission processing in addition to local and remote batch processing. NOS/VE operates in Virtual State and controls the computation of programs submitted through remote terminals and maintains normal batch processing operations for jobs submitted locally.

NIO

See Nonconcurrent Input/Output.

Nonconcurrent Input/Output (NIO)

An input/output unit architecture that functions with NOS.

NOS

See Network Operating System.

NOS/VE

See Network Operating System/Virtual Environment.

O

Operand Issue (OPI)

That portion of the central processor responsible for storage and distribution of the process state register values while a process is executing. OPI is contained by logic modules OPIA, OPIB, and OP/SM.

OPI

See Operand Issue.

OPI/SM

Operand issue/segment map.

OPIA

See Operand Issue.

OPIB

See Operand Issue.

P

P/N

Part number.

PM

See Preventive Maintenance.

Power unit

Provides power to support the electrical systems (logic, environmental, and so on) of the CPU. (The IOU has its own power supply.) The power unit occupies a cabinet that attaches to the CPU.

Preventive maintenance

1. (ISO) Maintenance performed specifically to prevent faults from occurring. 2. Contrast with corrective maintenance.

S

SIB

See Side Interconnect Board.

Side Interconnect Board (SIB)

SIBs are the printed-circuit boards that interconnect the central processor logic modules. The multilayered SIBs actually constitute the sides of the CP logic cages. CP-0 logic modules are interconnected with SIB A and SIB B, while CP-1 logic modules are interconnected with SIB C and SIB D.

Standalone IOU

The standalone IOU is an option that provides the CYBER 960/962 mainframe with a dual IOU configuration. The standalone IOU is installed on an island separate from the mainframe, but is linked to the CYBER 960/962 CPU with 50-ft cables. Up to ten peripheral processors (PPs) and ten channels reside in the standalone IOU cabinet.

Standalone IOU Expansion

A standalone IOU expansion product can be added to the standalone IOU, doubling the PP and channel capability of the standalone IOU configuration. The standalone IOU expansion and the IOU expansion differ only in their physical location relative to the mainframe.

System Console

The keyboard and display screen used to monitor and control the operating system.

V

V

1. Valid bit. 2. Also see Volt.

Volt (V)

A measure of the work needed to move an electric charge.

W

WDC

See World Distribution Center.

World Distribution Center (WDC)

Control Data's ordering and distribution center for spare hardware parts, software revision packages, and the documentation produced to support its product lines.

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